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Steam and its Condensation. By THOMAS PROSSER, C. E.

(Continued from page 294.)

CHAPTER VII.

On the Steam Jacket of Gordon McKay, Esq.

What is the precise nature of the information furnished by Gordon McKay, Esq., (*p.* 232, *anti*,) in relation to the economy of the steam jacket? I confess myself totally unable to comprehend it, except on the assumption, that the fuel consumed was in exact proportion to the water which left the boiler. I trust the presumption is a fair one, in the absence of any allusion whatever to the nature or quantity of the fuel consumed, which is in reality the only consideration worth notice, and which, therefore, I presume, was inadvertently omitted.

Still, I am not out of my difficulties in this matter; for I cannot comprehend how, in the first experiment, nearly one-third of "the water evaporated from the boiler" was "used in leaks of joints, boiler, &c." (There should be no *&c.*, in experiments of this kind,) 500·7 lbs. of water leaves the boiler, of which 164 lbs. is not accounted for as steam. Surely, then, it must have condensed in the cylinder, or gone over as water in a vesicular state, notwithstanding the steam jacket and four inches of cotton over that, for I cannot suppose Mr. McKay really means to be understood as using such a leaky concern, as his language implies. Therefore, putting the best construction upon it, it affords but little encouragement for steam jackets.

It appears that 15·7 lbs. of steam was condensed in the jacket and returned to the boiler as water at 328° F. to be re-evaporated, for it was just as much new water as if it had been taken from the reservoir, and is therefore very properly added to the weight of water evaporated, but note, its temperature was much higher. How much, we are not informed; but if we assume the reservoir water to have been at 60° F., we have 268° = (328—60). Now the latent heat of steam at 328° F. is about 856°, and if we multiply that by 15·7 lbs., we get 13439° of latent heat, which has gone into the cylinder to keep it warm—that is the cost of it. Well, we have against that, in the second experiment, 145 = (630—485) lbs. of water more than in the first experiment, which left the boiler and passed through the cylinder. Now as McKay acknowledges that the condensation is in proportion to the condensing surfaces, (and of course multiplied by the difference of temperature, which I have more than once shown in this *Journal*,) it follows that no more steam can by any possibility be condensed, for the cylinder attains the same normal state of temperature in both cases; and therefore the 145 lbs. of water additional must have gone over in a vesicular state, entering the cylinder at 328° F. and leaving it at 220°. Thus the cylinder has absorbed 108° = (328—220), which being multiplied by 145 lbs. gives 15660° of heat required to keep the cylinder warm, with vesicular water entering it on the inside and parting with its sensible heat, against 13439° of heat required on the outside thereof and within the jacket, with steam parting with its latent heat. But, 15·7 lbs. of the water in the first experiment, had a temperature of 268° higher than the same quantity of water in the second one; and if we multiply 15·7 lbs. by 268°, we have 4207·6° to be deducted from 15660°, leaving but 11452·4° of heat, or 1986·6° less to keep the cylinder warm without the steam jacket than was required with it. I am assuming here, that 26·3 lbs. of the vesicular water, after it had left the cylinder at 220° F., was available for re-evaporation in the boiler, as a set-off against the 15·7 at 328° in the first experiment, for 26·3 × (220—60) = 15·7 × (328—60). Doubtless more than this 26·3 lbs. of the 145 lbs. was available to economize the fuel, and therefore at whatever lower temperature the hot water assumed, the quantity of heat was available just the same, by increasing the quantity of hot water from an ample store.

I am really very sorry for steam jackets, for it certainly does look like being worth about 15 per cent. less than nothing.

This I think cannot be—but it is a legitimate conclusion, and the only one as it appears to me which can well be arrived at from the data given, and does support the view taken by "engineers of high standing, who deny the efficacy of the steam jacket," and consider it "a positive injury." Tredgold supports this view of the case and one of his editors the opposite.

I will mention here a fact which I have observed, that, in a boiler which ordinarily delivers its steam at more than 20° F. (and sometimes 47°) hotter than the water that it is produced from (caused by the tube heating surface passing through the steam), the temperature has been

41° F. below it. One thermometer was in the steam and another in the water; both were plunged into baths of mercury, surrounded with a jacket in fact, and well clothed with felt and canvass. The work light, the fire down, and damper open, the rush of cold air will at any time have a similar effect, although not often to such an extent as above noticed.

Now where there is no steam jacket, there is a greater draft on the boiler from the cylinder to keep up its normal temperature. If the steam is sufficiently surcharged, there is then no condensation in the cylinder (but there is a cutting up of the valve faces). If there is just the same amount of condensation as there is with a steam jacket, then the superheat supplies the place of the steam in the jacket. But, if the boiler cannot supply this *heat* in the shape of steam in a superheated state, it will supply it in the shape of vesicular water, that being the cheapest form in which it can do it, the temperature of the steam falls below that of the water from which it is produced, radiation is reduced, and the greater specific heat of water over steam is brought into economical operation; for, as I take it, a change of state cannot be produced at *no* cost.

I confess to having entertained different sentiments in relation to my old friend the steam jacket, and that I am now groping about in the dark, as it appears to me that Mr. McKay also is; at the same time I am much obliged to him, as everybody should be, for spending his money and his time in endeavoring to unravel the mysteries of this very difficult subject. As Mr. McKay has a boiler and engine constructed expressly for the purpose, may I suggest to him a repetition of the second experiment with a little alteration, viz: to place the reservoir sufficiently low to allow of the return of the vesicular water, and as much of the condensed steam as condenses spontaneous in the atmosphere, into a small vessel, at the top, and communicating with his reservoir at the bottom of both by means of a pipe, and taking his feed-water from the top of the small vessel, so as to pump all the hot water which offers into the boiler first.

By this means, and noting accurately the weight of fuel burned, I anticipate a saving in fuel will be observed.

By my "method of applying the power of steam and condensing the same," as described in this *Journal*,* I can, at will, produce this vesicular water, otherwise called priming, together with the water of condensation in the cylinder, and exhibit them in a manner which no other system admits of; and hence, even as a mere study of the physiology of the steam engine, it is highly interesting, and as a practical test of the fireman's skill and fidelity, entirely reliable. When the vesicular water is going over, the steam gauge does not necessarily fall, nor the water in the boiler lose in temperature; nay, even quite the contrary may happen and often does, but the temperature of the steam is invariably found to be below that of the water, a fact which I believe has never before been recorded if observed.

* Engineers affect to make a distinction between vesicular water and priming; in the latter case, they say, the water goes over in a body; but, where is the line of demarcation? What the difference?

When this vesicular water comes over in my system, and mixes with the condensed steam from the cylinder, it all goes to waste together, for nothing but pure steam enters the condenser; its temperature is ordinarily about 230° F., while that of the feed water may be, say, 200° F., in which case the 30° F. of difference is an entire loss, and hence it should be prevented and the steam worked moderately dry, but not so dry as to cause cutting of the valve faces, which will always occur when there is no condensation in the cylinder to lubricate them, in the absence of grease—a thing of very questionable utility in working with wet steam—which term properly applies, as I believe, to all steam made in the ordinary way, and I have no doubt that such steam is generally of a lower temperature than the water it is produced from.

To this cause, independent of steam space in the boiler, I attribute priming; for if a boiler makes the steam and *surcharges* it, just as fast as the engine takes it, there will be no priming, however small the steam space may be. But if the engine makes a suddenly increased demand upon the boiler, or if too much air is admitted over the fire, or the damper is too wide open, any of these may cause a fall in the temperature of the steam without a corresponding one in that of the water; and whenever the steam is at a lower temperature than the water, and not before, priming will commence, for the reason, as I have before stated, that hot water is cheaper than steam—the demand being not for more working steam only, but for more heat to keep the cylinder at the normal temperature, that is to say, at the same temperature as a steam jacket would keep it, due to that of the working steam whatever it may be; for the condensation of the working steam is not a per centage of that which enters the cylinder; therefore, the speed of the piston has nothing to do with it; it is a fixed quantity, and is the product of the surface to which it is exposed, and the difference of temperature between those factors. Expanding the steam modifies the action, not the principle, by causing water of condensation in the cylinder to re-boil on the removal of the pressure and thus resume its latent heat, thereby showing a higher degree of tension than is due to the expansion.

We may next consider the question of a steam jacket for low pressure, or rather I suppose we must say, for an air-pump condensing engine.

Now, with a steam jacket the steam leaves its latent heat in the cylinder, and returns the water at the same temperature as the steam in the boiler, and that water is re-evaporated as in Mr. McKay's first experiment. And without a steam jacket, as much vesicular water has to go over into the cylinder as will compensate, by its sensible heat, for the absence of the latent heat of the steam in the jacket. We need not go far to determine this question, for if Mr. McKay's second experiment has been rightly disposed of, as showing there is no advantage in the steam jacket when the effluent vesicular water and condensed steam from the cylinder are available as feed-water at a high temperature, we have only to ascertain the effect of reducing the temperature of that water 100° F. lower in consequence of the intro-

duction of the air-pump condenser. The product of $15{\cdot}7 \times 100°$ is 1570°, which is only about one-tenth of the heat required to keep the cylinder warm according to the experiments; and therefore, if a gain in fact, it is one not worth incurring the expense of a steam jacket to obtain. More particularly is this the case with the method which I have adopted of surcharging the steam (making that, too, a part of the economic supervision through the medium of two thermometers), for the same effect is produced and in a much better manner. By surcharging the steam we prevent vesicular water going over into the cylinder (priming), and as far as is desirable the condensation of the working steam therein. This superheat goes into the cylinder and keeps up its normal temperature by which the amount of condensation allowed is governed. And thus the hot water remains in the boiler, which will otherwise have to go over into the cylinder, and from thence into the condenser, where its life is extinguished in a "wishy-washy everlasting flood" of cold water, which has to be pumped back again into the boiler against the pressure of the steam therein.

The steam jacket came into existence, as Mr. McKay observes, in 1769. The air-pump came with it. As in the ethical so in the physical sciences, one false position requires another to back it. The steam jacket would never have been thought of, had not the air-pump been introduced. They have both now attained to a respectable old age, and had better be allowed to die in peace. "Proselytes are ardent partizans," and I am a convert of but a week old to this new doctrine. I have arrived at the conclusion stated, solely by observing the phenomena exhibited by the two thermometers alluded to. The Board of Engineers appointed by the Hon. Isaac Toucey, Secretary of the Navy, to examine into my system, consists of Messrs. Isherwood, King, and Everett; and the former of these gentlemen suggested that a thermometer be placed in the steam space of the boiler to compare with the steam pressure as shown by the gauge, for the purpose of ascertaining the amount (*if any?*) of superheat in the steam. This was done, but nothing could be made out of it. The pressure and temperature appeared to have no sort of connexion with each other, but were perpetually varying. I then placed a thermometer in the water also, and the cause of the erratic movements of the steam was at once discovered, and will, I confidently predict, throw more light upon this difficult subject than it has ever before received. The extreme observed range of variation in the temperature of the steam, above and below that of the water from which it was produced, has been thus far 88° F.; that is to say, the steam has been observed at 41° below, and 47° above the temperature of the water.

The extreme susceptibility of the steam to the action of the fire, at once shows whether the combustion is proceeding properly or not, and two thermometers should therefore be placed upon every boiler to guide the fireman and indicate whether he is skilful, vigilant, and faithful, or not, for there is no possible means by which he can evade the searching scrutiny of those silent monitors.

*The Magnitude of the Public Works of the United States.**

From the New York Times.

It has been fashionable to compare unfavorably the works of this country with those of Europe. To such an extent has this been carried that it is not unfrequently said that we have to look to England or the Continent for most of our examples. We are continually told by travelers of the great extent, beauty, and durability of the continental works, and of the enormous strength of the English structures. Now it is perfectly true that Europe can boast of the railroads, canals, bridges, and aqueducts unrivaled in the world for beauty and excellence of workmanship and design, but it is equally true that America can point to works of utility that, in the magnificence of their proportions, are not exceeded anywhere.

The Julian Aqueduct, of Rome, is two miles longer than the Croton Aqueduct, of New York, built by John B. Jervise and Horatio Allen, but the Croton carries more water than all the seven aqueducts of Rome put together, and more than any other aqueduct in the world, and is longer than any other, excepting the Julian.

The Illinois Central Railroad, built by Col. Mason, is the longest line ever constructed by one company, and in point of workmanship is equal to any European road.

The National Road over the Cumberland mountains, built by the United States Engineer Corps, is more extensive and durable by far than the Appian Way.

The stone arch over Cabin John's Creek, on the Washington Aqueduct, built by Captain Meigs, is about fifty feet greater than any other stone arch in the world, and is more beautiful in proportion than the arch over the Oca, so long celebrated for its magnificence.

The tunnel built by Mr. Haupt, on the summit of the Pennsylvania Railroad, was a more difficult work than the tunnel under the Thames.

The structures on the Baltimore and the Ohio Railroad at Harper's Ferry, and beyond the summit, built by Latrobe, and the Starrocca Viaduct, on the New York and Erie Railroad, built by Julius Adams, are equal in magnificence and excellence of workmanship to anything Brunel ever did in England, or Moran in France.

The Suspension Bridge over the Niagara River, at Lewiston, built by Major Serrell, is 1042 feet 10 inches in one span, and is 43 feet greater than any other single span in the world, being nearly twice as great and quite as strong as Telford's celebrated bridge over the Menai Straits in England.

The United States Dry Dock at Brooklyn is the largest dry dock in the world by many feet. The workmanship, done under the direction of Mr. McAlpine and General Stuart, is equal, if not superior, to anything of the kind anywhere. The plates of iron used in the gates of this dock are the largest that had been made up to the time they were rolled.

The flight of combined locks on the Erie Canal, at Lockport, built by the State Engineers, is equalled only in one other place in Christendom—Sweden.

* From the Salem Register, April 21, 1859.

The Railroad Suspension Bridge, built by Rœbling, over the Niagara, is within a few feet of twice the span of Stephenson's great Tubular Bridge in England, the largest structure of the kind. It is 800 feet in one span, and is two stories high, the railroad being above the public highway. Nothing like this exists anywhere else.

The Light-house on Minot's Ledge, being built by Captain Alexander, is in a more exposed situation, and, as far as proceeded with, is more securely bolted together than the famous Eddystone Light-house in England.

The Bridge at Wheeling, built by Charles Ellet, is exceeded only in span by the Lewiston Bridge, and is heavier than it; it is the second largest span in the world, and is much more beautiful than the Fribourg Bridge, its European rival.

In carpentry we are unexcelled in the world. Such structures in timber as the Dry Docks at San Francisco and Philadelphia, McCullam's and Col. Seymour's bridges on the Erie Railroad and branches, the timber viaducts on the Cattawissa Railroad, built by Stancleff, Col. Long's bridges on the various New England railroads, and How's trusses at Harrisburg, have not their equals across the Atlantic.

Then, again, in Europe many structures are built that might have been avoided—a few hundred rods of detour would have saved the great Box tunnel. Now we maintain that the location of Sidell's division, for example, on the Erie, evinced more skill in avoiding the necessity of great structures than could be shown in building them.

The stones on either corner of the Exchange in Boston, built by Rodgers, are larger than any single stone in Cleopatra's Needle, and those now being put into the United States Treasury, at Washington, are much heavier than any stone of Pompey's Pillar, or the Pyramids of Egypt.

As to the difficulties of location, there is no country where more science and skill have been brought to bear than in ours, and it is a remarkable fact that, in point of time, last year, our average traveling was faster by two and a half miles per hour than in England, comparing our principal lines with theirs, while the charges on the American lines were but little over half the English rates.

The reason why these things are not generally known is, that here we build a great work, announce its completion in the same advertisement that heralds the opening of the road, and no more is said about it, except, perhaps, what may appear in one or two scientific periodicals, where dry feet and inches, stress, strain, and torsion are discussed, and are never read except by the professional engineer.—While on the contrary, in England and France, as soon as a great work is built, and while it is being erected, pictures by thousands are published, medals are struck and circulated, glass models are made, and the illustrated newspapers show it in every stage of progress and from every point of view; the engineer is knighted, if he is not already of the nobility, and the fame of the structure is sent from land to land; while with us, as we have shown, may be found some of the most gigantic works ever undertaken that are passed by and

over without hardly any notice. It is remarkable that the best popular descriptions of our own public works of great magnitude are to be found in the journals of France and Germany. AMERICUS.

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*On the Successful Working, by Locomotive Power, over Gradients of 1 in 17, and Curves of 300 feet radius, on inclines in America.** By Mr. T. S. ISAAC.

[Read before the Institution of Civil Engineers, Nov. 25, 1858.]

(Continued from page 310.)

Discussion.—It was explained that on the Baltimore and Ohio Railway the ordinary goods engines had cylinders of 19 inches diameter, with a stroke of 22 inches: they had eight driving-wheels, of 3 ft. 7 ins. diameter, all coupled. The passenger engines principally employed on the inclines of 1 in 45½, had cylinders of 19 inches diameter and 22 inches stroke, with six driving-wheels, 4 feet 2 inches diameter, all coupled, and a leading truck or "bogie" on four wheels. Peculiar arrangements were made for facilitating the passage over curves of small radius: the centres of the front and hind wheels were only 11 ft. 3 ins. apart, and the intermediate wheels were without any flanches,—the springs being so adjusted as to equalize the weight.

It was stated, that the adhesion of driving-wheels had been shown, from experience in the United States, to be beyond the limits usually assigned. Instances were known where the effective adhesion had been as much as two-fifths of the nominal weight on the driving-wheels; it being assumed that this varied much when running, as compared with the actual weight ascertained by the weighing machine when at rest.

On the Cleveland and Pittsburgh Railway, on the 1st August, 1857, a train of fifty loaded wagons, each on eight wheels, and weighing, with the engine and tender, 800 tons, was drawn up a continuous incline, two miles in length, of 1 in 132. The engine weighed 26·8 tons, with only 19·2 tons on the six coupled wheels. The gravity of the entire train would be 13,575 lbs., whilst the friction, which could not average less than 5 lbs. per ton, would increase the amount to 17,575 lbs., or to more than two-fifths of the weight upon the driving-wheels.

In making a series of trials for the New York and Erie Railway, Mr. Zerah Colburn drove a train of eighty wagons, each on eight wheels, weighing, with the engine and tender, 1270 tons, up a continuous incline of about 1 in 480, with curves of 1145 feet radius. The gravity being 6000 lbs., and the other resistances 8300 lbs., the entire resistance was 14,300 lbs. The weight on the driving-wheels of the engine, at rest, was 40,500 lbs.; hence the adhesion was 0·35 of the insistent weight.

An engine, when on a severe incline, changed its position so much as to alter materially its running condition, which should be provided for in building engines expressly for working inclines.

It was stated that, at the time of construction of the Mountain Top Incline, it was found necessary to place a tank on the eastern slope,

* From the Lond. Mechanics' Mag., Dec., 1858.

on a gradient of 1 in 18·87. During the first two or three summers, the ascending trains were in the habit of stopping daily, and the engines were able to start again without difficulty. There was one engine on the mountain on eight wheels, all coupled; the cylinders were 18 ins. in diameter, with a length of stroke of 22 ins.; the wheels were 3½ feet in diameter, and the gross weight of the engine was 27 tons. This engine had crossed the mountain six times in one day, with a load of 49 tons each time; making the trip in one hour from Turntable to Greenwood, and in one hour and a quarter from Greenwood to Turntable; although it was very rigid and was not adapted to the curves. One of the lighter engines had taken a load from Turntable to Greenwood in half an hour. Mr. Ellet had published a statement of the cost of working, based on the fuel and oil consumed, and the wages of the workmen. Fuel on the mountain cost two dollars per cord. It was difficult to make a just comparison of the various fuels, and to obtain correct information as to the water evaporated. The same cause that prevented the experiments on the resistance of curves, prevented comparative experiments on fuels, and accurate statements of the water evaporated. At first pine was used, but oak had been extensively adopted latterly. The effective pressure of the steam, above that of the atmosphere, usually amounted to from 100 lbs. to 120 lbs.

It was remarked that, whereas, on most English railways, the results of experience showed a resistance of 12 lbs. per ton gross on a level, yet some of the statements which had been made as to the working of railways in the United States, seemed to indicate a resistance of not more than 5 lbs. per ton gross, after allowing for gravitation on the incline; whilst the permanent way of American lines was notoriously inferior in all respects to that of the English lines. The first of the results named in the paper showed a traction resistance of about 150 lbs. per ton gross. In contrast with this, it was stated that, on the Great North of Scotland Railway, near Aberdeen, the Kitty Brewster Incline of 1 in 59, and full of quick curves, had been worked for the last three years by two tank locomotives, having cylinders 15 inches diameter, with a length of stroke of 24 inches, and four wheels coupled, each 4½ feet diameter, at a steam pressure of 150 lbs.; the load on the driving-wheels being 15 tons, on the leading wheels 10 tons, and the gross weight, in working order, 25 tons. The trains were started from the foot of the incline. One of these engines could take up nineteen wagons, weighing, when loaded, about 11 tons each—making a total gross weight of train, behind the engine, of 200 tons—at 10 miles per hour. The greatest load that had been taken was twenty-one wagons, of a gross weight of 230 tons, at five miles per hour. The average ordinary train taken up the incline, consisted of eighteen wagons, each weighing 8 to 11 tons gross; the total weight being, say, 160 tons gross, at 10 miles per hour; but excursion trains of loaded carriages, weighing, when empty, 5½ tons each, and 7½ tons when loaded, making a gross load of, say, 200 tons, had also been taken up. The resistance of the train indicated on the piston, after allowing for gravitation on the incline, amounted to 13 lbs. per ton gross of engine, tender, and

trains, which contrasted favorably with the estimated traction resistance of 150 lbs. per ton gross on the American incline.

With reference to the influence of curves upon resistance, it had been found that, at a speed of 45 miles per hour, the traction resistance was greater, by 20 per cent., on a line having curves under one mile radius, at the rate of one curve in 2½ miles, than on a practically straight line.

It was remarked, that the Whitstable branch of the South Eastern Railway, on which there was a gradient of 1 in 30, had originally been worked by stationary engines and rope traction; but as the traffic was intermittent, it had been determined, some years ago, to substitute locomotive power, and this application had been quite successful. Bury's four-wheel coupled engines, having cylinders 14 inches in diameter, with a length of stroke of 24 inches, the wheels being 4 feet 6 inches in diameter, were still in use on this branch. Four trucks of coal were taken up the incline of 1 in 30,—the gross weight, including the engine and tender, being about 50 tons.

On the Folkestone Branch of the same line, which had an inclination of 1 in 30 for upwards of three-quarters of a mile, four-wheel tank engines, constructed on Mr. Crampton's plan, were employed. The four wheels of 4½ feet diameter were all coupled; the cylinders were 16 inches diameter, with a length of stroke of 24 inches; the weight of the engine was 26½ tons, and the pressure of the steam was 120 lbs. per square inch. These engines had taken up the incline a load of fourteen carriages, equal to a gross weight of 100 tons, including the engine.

It was believed that the peculiar construction of the engines and carriages in the United States, tended to lessen the resistance of curves. It was well known that, in New York, and in other American cities, the railways were brought into the streets,—horse power being then employed,—and that the trains were conducted round the turnings of streets with great facility. As to the cost of construction of American railways, it appeared from official returns, which had been carefully compiled, that in the State of Massachusetts, the cost of the principal lines had amounted to £10,599 per mile, or £9489 per mile, exclusive of rolling stock. In the State of New York these figures were respectively £11,200 and £9762 per mile. It should be stated that a large proportion of the American railways consisted of single way, and that their cost ranged between £5000 and £14,000 per mile.

The Manchester, Sheffield, and Lincolnshire Railway, with a gradient of 1 in 130 for upwards of 22 miles, was mentioned as a case of a main trunk line, upon which there was a large traffic, necessitating the employment of heavy engines. Ordinary inside cylinder engines were employed,—the cylinders being 18 inches in diameter, with a length of stroke of 24 inches; the wheels being 5 feet in diameter, all coupled. They weighed, when in working order, 31 tons, were worked at a pressure of 130 lbs. to the square inch, and would draw a load of forty wagons, weighing 130 tons, independent of the weight of the engine and tender.

The great feature in the paper under discussion was thought to con-

sist in the statement, that two-fifths of the weight of the engine had been obtained as adhesive capability; whereas, in this country, one-fourth had been considered as much as could be relied on, in all states of the rails. On the West Cornwall Railway, loads of about 13 tons had been conveyed up an incline of 1 in 13, for a distance of from a half to three-quarters of a mile. The engine had four wheels coupled, and cylinders 13 inches in diameter. This plan had been considered preferable to the employment of stationary power. On the South Devon line there were gradients varying from 1 in 41 to 1 in 51, with S curves of 15 chains radius. As a practical fact, it might be recorded, that the engines would take seven loaded wagons up an incline of 1 in 41, on straight portions of the line; but when they came to curves of 15 chains radius, one of the wagons had to be removed.

It was stated that, on the Lickey Incline of 1 in 37½, an engine had been allowed to attain a speed of thirty miles in descending, and it was then brought up in 30 seconds, by the application of a peculiar kind of brake to the wheels of the engines.

With regard to zigzag inclines, for traversing mountains, it was stated that the late Mr. George Stephenson had suggested their adoption, thirteen years ago, on a line in Spain. Mr. Drane had also recommended that this method of crossing high mountains should be adopted in Ceylon; and more recently, as was well known, Mr. I. J. Berkley, M. Inst. C. E., had carried out the system successfully on the Great Indian Peninsular Railway, for ascending the Bhore Ghaut. It was thought that they were only desirable under special circumstances and in peculiar positions, where it was impossible to make a continuous line except at great cost, or by the introduction of excessively sharp curves.

Probably the steepest gradients in this country over which a large traffic was conveyed, were on the line between Manchester and Oldham, a distance of seven miles. For a mile and a quarter there was an inclination of 1 in 48 or 1 in 50. The line was then tolerably level, until, on approaching Oldham, gradients of 1 in 30 and 1 in 39 were encountered, and for about a mile and a quarter 1 in 27. This latter incline had originally been worked by stationary power and rope traction; but about five years back the locomotive had been substituted, and no difficulty was found in taking up considerable loads.

In closing the discussion, the circumstances under which steep inclines could with propriety be adopted, were considered; and it was remarked that, as a mechanical question, there was no difficulty in apportioning the power of the engine to the amount of adhesion required to traverse a particular gradient. But inclines of 1 in 10 or 1 in 17, or even 1 in 40, would only be resorted to from necessity, as such gradients were attended with a heavy cost for working expenses. On a branch of the Stockton and Darlington Railway, where there was an exceptional gradient of 1 in 40, although the traffic was all down hill, the whole of the receipts of that portion of the line, taken at one penny per ton per mile, were absorbed by the working expenses. If the loads had been up hill, it was believed that the working

expenses alone would have amounted to three pence per ton per mile, and, with gradients of 1 in 17, it was thought that this must reach one shilling to eighteen pence per ton per mile. In fact, it was questionable, under such circumstances, whether horse power and carts would not beat the locomotive in point of economy; though, of course, on a long line of railway, it would be most undesirable to introduce a break of gauge. It was undoubtedly more economical to employ locomotive power on the Whitstable branch, where the amount of traffic was so inconsiderable. On the Oldham incline, the necessity of preserving an unbroken communication was a justification for the use of the locomotive, the cost of which, in such a case, must be considerable. On the incline of 1 in 26, near Liege, a perfect system of stationary engines had been in use for many years. The Belgian Government, feeling the inconvenience of that system, had abandoned it, and substituted the locomotive; but such was the uncertainty of the power, in meeting the inequalities of the incline, that the stationary engines had been again resorted to.

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*American Railways.**

An impression prevails in London that American railways are in reality, notwithstanding their fair dividends, poor properties, because the iron of which they are constructed is comparatively bad—bad as compared with the metal generally used for the rails of our lines.

It is, no doubt, the fact, that the rails of American lines generally are indifferent stuff. The iron had to come from this country; and being paid for in bonds, it is said the iron-masters took advantage of their position, and palmed off on the "Yankees" inferior material. It may be remarked that they did the same in some of our modern English railways. But let that pass. Admit that the American railways are composed of poor rails. As a question of £ *s. d.*, what does it amount to? It amounts to costly working. Nothing more. The cost is annual, and it resolves itself into an enlargement of the working expenses. Be it remarked that the American lines, as compared with the English, are extremely costly in working, which Messrs. Zerah Colburn, and Alexander Holley, two distinguished authorities, ascribe principally to this very defect of the permanent way. The dividends of American railway stocks would doubtless be higher were they to substitute good rails for bad, which we may expect they will do as they have now found their error out. The additional cost would not be much, comparatively speaking, and they would soon make it up in savings of working expenses. According to the last Board of Trade Report of English railways (by Captain Galton) the average working expenses of heavily taxed British railways were 47 per cent., while those of American railways were 54 per cent.

If American railways were as substantial as our English lines generally are, they would yield even higher dividends than they now do. Their capital accounts would not, as we have said, be much increased, while their savings in working would pay a high per centage on the additional capital. Notwithstanding their extremely high rate of expense

* From Herapath's Journal, No. 1022.

for working, the American lines in 1857 yielded a traffic profit on their capital of 6·7 per cent., while the British railways in 1857 yielded only 4·11 per cent. Thus as a property, the American lines are now more than 50 per cent. better than ours; but if the condition of their rails, &c., admitted of as much economy in working, they would be better still. They have the great advantage, which nothing can take away, of economy in capital outlay, such as avoiding frightful law, Parliamentary land compensation, and other expenses, which in this country have run away with capital wholesale without purchasing any substantial property. Nearly every old American line could not now be made for what it originally cost, the land and labor having so much advanced in value.

Some of the best paying new English railways, and there *are* paying new lines here, have been laid with poor iron, which detracts from their value but does not destroy it. They would have been better properties had they been blessed originally with better iron, the badness of which adds and will add for years to their working expenses. In course of time good rails will be substituted for defective ones, and then the profits will be as they originally would have been had the construction been fair in the first instance. Let it never be forgotten that such a thing as a *worn-out* sound rail is almost unknown. Extremely heavy rails are no good. They are destroyed as soon as lighter ones, if they are unsound. Get rails of the best material, and well laid, and no amount of traffic will produce any sensible effect upon them during a long series of years or in a life time. Ask the Stockton and Darlington Company their experience in the matter.

We have written these few remarks to correct the popular but really very silly notion that American railway dividends are unsound because their rails are unsound, the truth being that the dividends would increase were the permanent way in better order. The American heavy repairs and renewals are charges against their current revenue accounts.

"*Account of Experiments upon Elliptical Cast Iron Arches.*"*

By T. F. Chappe, M. Inst. C. E.

[Read before the Institution of Civil Engineers, March 15, 1859.]

These experiments were undertaken at the request of Mr. W. H. Barlow, M. Inst. C. E., for the purpose of ascertaining practically the safe load to which elliptical cast iron arches might be subjected, as well as the most economical distribution of the metal. The intrados of the arches was in all cases a segment of an ellipse, in order to obtain the greatest headway at the haunches. The experiments were, in each case, conducted upon two ribs, placed two feet apart from centre to centre, and resting on cast iron abutment pieces, keyed-up tight against the springings. Diagonal stays and longitudinal struts were also introduced to prevent lateral motion.

* From the Lond. Civ. Eng. and Arch. Journal, April, 1859.

The first experiment was made upon a model, one-fourth the real size, of one arch of a bridge intended to be erected over the river Trent near Newark. The (model) arch had a clear span of 14 ft. 6 in., and a rise of 16 inches; a camber of ¼ of an inch being given in fixing the halves together. The sectional area of the arch at the crown was 2·43 inches, —that of the curved rib near the springing 2 inches,—about midway between the springing and the crown 1·75 inch, and of the spandril 1·34 inch. The weight of each arch was 1 cwt. 2 qrs. 22 lbs.

The other experiments were made upon a model, one-sixth the real size, of an arch erected over the Gloucester and Stonehouse and Great Western Railways, at Standish, six miles from Gloucester. The dimensions of the model were—span 13 ft. 10⅔ in., and rise 1 ft. 10 in. The sectional area at the crown was 1·25 inch, of the curved rib near the springing 1·055 inch, about midway between the springing and the crown 0·993 inch, about the middle of the upper rib 0·883 inch, and of the spandril 0·57 inch. The weight of each arch was 3 qrs. 26 lbs.

The following pressures were given as those to which the arches were subjected in these experiments:—

Experiment.	Ultimate load.		How distributed.	Pressure per square inch of sectional area.	
				At crown.	At smallest section.
No.	Tons.	cwt.		Tons.	Tons.
1	30	10	Uniformly.	8·52	11·83
2	18	0	"	6·80	8·58
3	12	0	Partially removed from the haunches.	4·54	5·72
4	5	0	On one haunch.	2·36	2·98
	3	12	At centre.	2·93	3·70
5	3	14	"	3·00	3·85

In the first experiment the ultimate pressure was not reached. In the second and third experiments one-half the arch was out of line laterally, beyond what would be permitted in practice, and was wanting in that assistance which would have been afforded in the number of ribs required for the width of a bridge, so that the ultimate pressures indicated were below what such arches might be estimated to bear. This was also the case in the two last experiments, in which the castings were faulty, and the tests such as were not likely to occur in practice. It was thought that cast iron arches of the form experimented upon, might safely be considered capable of bearing a pressure of between 8 and 10 tons per square inch of section. From the position of the fractures it was believed that the spandrils were too weak in proportion to the size of the arches.

The communication was accompanied by several tables, showing the deflections on the application of the different loads.

AMERICAN PATENTS.

List of American Patents which issued from March 29 to April 12, 1859, (inclusive,) with Exemplifications.

MARCH 29.

328. Friction Belt for Flour Mills; L. S. Reynolds, Indianapolis, Indiana.

Claim—1st, The sliding knockers, in combination with the shaft, ribs, and rods, when constructed as set forth. 2d, The springs, in combination with the knockers, when operated as set forth. 3d, The elastic bridge-tree, when used as set forth.

329. Cultivators; T. A. Robertson, Washington City, D. C.

Claim—The wing extended obliquely from the rear standard to a point, from which point projects a straight portion or divider, in combination with the oblique cutting bar, as described.

330. Stoves; H. R. Robbins, Baltimore, Maryland.

Claim—The combination of the fire chamber with the inclined front encircling transparent face plate, heat plate, pedestal with its doors, upper back encircling chamber with its doors, and divided horizontally, smoke and heat pipes, and back case or reflecting bonnet, having a conduit arranged to conduct air to the one perforated passage of the upper back encircling chamber, as described.

331. Cotton Press; J. G. Roux, Raymond, Mississippi.

Claim—The rotating platform provided with helical ledges or rails, in combination with the blocks placed on the ledges or rails, the levers, attached to the follower and the stationary press-box, arranged as set forth.

332. Railroad Cattle Guard; J. L. Rowley, Angola, Indiana.

Claim—The springs and bar, in combination with the chain fender and post, when constructed in the manner described.

333. Harvesters; I. S. and H. R. Russell, New Market, Maryland.

Claim—The peculiar arrangement of two segment level wheels, two spur wheels, an independently turning hub, having a slotted plate attached to it, and a crank arm, having a turning crank pin for giving motion to the rake round the reel in the path of a vertical circle, and over the platform in the path of a horizontal circle, as set forth.

334. Forging Machine; Erhard Schlanker, Buffalo, New York.

Claim—That portion of the hammer shaft from the centre pins extending towards the driving shaft, to be used as a lever in controlling the hammers, the centre pins being the fulcrums in connexion with the wrists and friction rollers, the location and position of the spring cams upon the duplicate face plates. The sections and the independent operating crank cams, guide plate, cranks, levers, and connecting rods, as described.

335. Coffins; I. C. Shuler, Amsterdam, New York.

Claim—1st, The manner of forming a recess in the sheet metal all around the base inside of a metal coffin; also, the arrangement of placing an iron frame, or its equivalent, into the recess described, fastening it firmly to the sheet metal all around the body of the coffin, for the purpose of stiffening the lower edges of the same. 2d, I do not claim the ribs separately, as I do not consider them tenable, but the ribs being peculiarly arranged by being placed under the flanch which supports the rim, and fastened to the frame in the recess at the bottom—I claim this peculiar arrangement for the purpose of stiffening the sides and end, so as to sustain a heavy weight of earth; also, for the purpose of preventing the sides from bilging out, when the handles are placed about an equal distance between the upper and lower edges of a sheet metal coffin. 3d, The arrangement of pressing or rolling around the outer edge of the cover of a sheet metal coffin, an inverted bead which forms a tongue on the bottom side of the cover, so arranged as to fill the groove in the upper surface of the rim, for the purpose of soldering or cementing the joints. 4th, The arrangement of placing a galvanized iron rim, or its equivalent, on the outside and over the upper edge of the walls of a sheet metal coffin, fastening the same permanently to a flanch formed all around the upper edge of the walls, for the purpose of shaping and strengthening the upper part of the coffin, and at the same time furnishing a means of securing the coffin top at the joints. 5th, I am aware that I have claimed in a former patent an iron frame as a cover over the soldered joints on the top of a sheet metal coffin; I therefore disclaim it as an entire frame: but I claim the bi-section of the frame and its re-connexion by means of spring catches at the widest part or break of the coffin.

336. Cultivator; John Smally, Bound Brook, New Jersey.

Claim—The frame, its adjustable pole, its teeth and detaching teeth, the cranked shaft, its central lever, and driver's seat, when the said seat is so situated as regards the handle that the driver can operate the latter without moving from the seat, and when all the parts are arranged in respect to each other, as set forth.

337. Seeding Machines; Michael Simmons, Ira, Illinois.

Claim—1st, The use of the eccentrically cut gear wheel, so as to enable me to get my pinion and pinion shaft on top of the frame, and above the centre of the wheel that drives it. 2d, The arrangement of the beams with their skewed shovels and adjustable connects, so that they may be transposed from side to side of the machine at pleasure, in the manner explained.

338. Spring Bedstead; C. F. Spencer, Rochester, New York.

Claim—The combination and arrangement of the spring slats with the bars and fulcra, the latter arranged to increase or diminish the effect, and horizontal slats resting at once on the free ends of each reverse series, in the manner described.

339. Smut Mill; G. H. Starbuck and D. D. Gilman, Troy, New York.

Claim—1st, The combination of the two scouring plates placed one above the other, with their roughened or burred surfaces toward each other, in combination with the funneling plates for depositing the grain at the centre of the scourers, between which it is passed, forming a double scourer attached to, and revolving with, the shaft, operated in the manner set forth. We do not confine ourselves to any number of scourers for a machine. 2d, The vertical cylindrical opening, in combination with the outer case, screen, and fans, for the

purpose of giving free discharge to all light impurities and foreign matter, and preventing the discharge of grain.

340. WATCHMAKERS LATHE; R. H. St. John, Bellefontaine, Ohio.

Claim—The combination and arrangement of the steel ring, spring, set-screws, and centering plate, as described. Also, the employment of the screw cap for clamping the article to be centered, in the manner specified.

341. CULTIVATORS; J. C. Stoddard, Worcester, Massachusetts.

Claim—1st, The share and wings or blades arranged relatively with the wheel or wheels, that is to say, placing the wheel or wheels behind the share and between the wings or blades. 2d, The adjustable rotating scrapers applied to the wings or blades. 3d, The combination of the lateral adjustable hoes, share, adjustable wings or blades, rotating scrapers, wheels, one or more, arranged as set forth.

342. CRESSET FOR HEATING BARRELS; John S. Thompson and Marvin J. Seymour, Glenn's Falls, New York.

Claim—The arrangement of the annular bed at the base of the apparatus and above the escape flue, to receive and support the barrel.

[This invention consists in having an upright cylinder or drum attached to an ordinary box stove, the stove and drum being provided with a return flue, and the stove with an annular bed.]

343. MACHINES FOR DIGGING POTATOES; J. C. Stoddard, Worcester, Massachusetts.

Claim—1st, The weed eradicator formed of the vibrating plate with serrated flanches, attached and arranged as set forth. 2d, The inclined adjustable screen box provided with a share and spur at its lower end, in combination with the endless chain of carriers arranged to operate in grooves. 3d, The combination of the weed eradicator, leveling share, inclined adjustable screen box, with share attached, and endless chain of carriers, with or without the receptacle. 4th, The adjustable or movable roller shaft applied to the machine, and arranged as set forth.

344. MANUFACTURE OF WOOD SCREWS; N. G. Thom, Cincinnati, Ohio.

I do not confine myself to any particular form of construction as to size, shape, &c., as these may be varied indefinitely, and the same construction is applicable to coach or lag screws, or any other screw in which wood, or other yielding substances, constitute the material into which the screw is driven.

Claim—The described wood screw, which consists in its having two or more parallel threads that terminate at or near the point of a tapering core, as described.

345. SADDLES; S. E. Tompkins, Newark, New Jersey.

Claim—The bow-pieces, connected with the sides and provided respectively with the head and cantel, in connexion with the central bow-piece or "safety guard," when the parts are placed relatively with each other, so as to admit of being cast in one piece. Further, in connexion with the saddle-tree, formed as above, the crupper loop attached to the cantel bow-piece, by means of the plate.

346. STOVES; F. E. Tupper, Nashua, New Hampshire.

Claim—The arrangement of the air chamber with its air passages or tubes and apertures, and openings, with the casing, supporting, and deflecting collar, in the manner set forth.

347. HARVESTERS; S. W Tyler, Greenwich, New York.

Claim—Giving such a shape to the portions, a and b, of the finger-bar, and to the flanched portions or heads of the fingers, that the same set of rivets will unite all the said parts with each other into a fingered bar of unusual stiffness, strength, and narrowness, and at the same time form a dovetail groove for the reception and guidance of the cutter bar.

348. MACHINE FOR ROLLING WHEEL TIRES; Nathan Washburn, Worcester, Massachusetts.

Claim—The combination of a set of reducing rollers, a series of adjustable carrying rollers, and a frame or holder, supported so as to be capable of rising upward within the wheel tire in proportion as the diameter of the inner periphery of the said tire may increase during the process of rolling the tire, and having the said carrying rollers arranged and made adjustable with respect to it and the reducing rollers, in manner specified.

349. CLOD CRUSHERS; E. B. Way, Jerseyville, Illinois.

Claim—The employment of the oblique-sided double tapered slats, in combination with the rims, so that the clods that wedge between the slats will be carried up, and then dropped, and broken within the wheel.

350. SAUSAGE-STUFFER; John Wagner, Pittsburgh, Pennsylvania.

Claim—The arrangement of using in addition to the operating crank for the forward motion, another operating crank for the backward motion, when applied to the wheel gear arrangement of worm and wheel, in the manner described, viz: when set on the spindle of the screw wheel.

351. HARVESTING MACHINE; Wm. Webber, Jr., and John Webber, Rockton, Illinois.

Claim—Operating the rake of a harvester by means of the horizontally oscillating arms, the rod, and the latch, arranged in the manner set forth.

352. STOVES; J. Whitehead, South Paris, Maine.

Claim—The combination with the fire chamber described, and with an oven having hollow walls filled in with a non-conducting material, of a removable fire chamber casing, which has hollow walls, filled in with a non-conducting material, and is in shape, externally, nearly the counterpart of the fire chamber, and serves for encasing the whole of the exposed portion of the fire chamber, and at the same time allows access to the holes in the top of the fire chamber and to the fuel door thereof, as set forth.

353. FLY-TRAP; Elisha D. Blakeman, Assignor to Jacob J. and Levi Auchampaugh, New Lebanon, New York.

Claim—The combination and arrangement of the poison cups with the conical chamber and bed-plate, as set forth.

354. MACHINE FOR ROLLING IRON; Henry B. Comer, Assignor to self and Joseph S. Lewis, Temperanceville, Pennsylvania.

Claim—Furnishing rolls which are placed in front of each other and on parallel lines with guides placed between each set of rolls, said guides being so constructed that they will guide and change the position of the iron as it passes from one set of rolls on to another set, as described.

355. FOOT-SCRAPER; W. L. Williams, City of New York.

Claim—The employment or use of the scraper and the brushes, either with or without the brush, arranged as set forth.

356. METHOD OF OPERATING THE KNIFE IN RIVING SHINGLES; John Wood, Brooklyn, New York.

Claim—Giving the frame in which the reciprocating knife gate is placed an intermittently vibrating movement simultaneously with the feed movement of the bolt.

357. SELF-FEEDING PRESS FOR PRINTING CARDS AND BILL-HEADS; Nathan Ames, Saugus, Assignor to self and Nathaniel Evans, Jr., Boston, Massachusetts.

Claim—1st, The little cams or projections arranged in reference to the ink rollers, and operating in connexion with them and the vibrating type-bed, as described. 2d, The combination and arrangement of the spring, hinged piece, type-bed, and spring, in the manner set forth. 3d, Attaching the type-bed at one of its sides only to the arm, so that the inking rollers may pass over and under it. 4th, The pitman, r', screw, r, top piece, x, slot, j, and slide, e e', when arranged as set forth. 5th, Attaching the feeding plate, f, to the slide, e, and causing the latter to move in the groove, g, so that while the upper side of f, bears on the surface of x, the thickness of e extending below it, prevents the card from ever getting between the surfaces of f and x. 6th, The adjustable guide, arranged as described. 7th, The adjustable lateral guides, arranged as set forth. 8th, The card-pusher provided with the slots, in the manner described.

358. CAR COUPLING; James W. Carrier, Assignor to self and Able B. Howe, Springfield, Massachusetts.

Claim—The sliding bunter, A, connexion pin, d, pin, p, springs, r and l, straps, m, sliding pin, B, springs, k k, rack, f, pinion, g, ratchet, s, pawl, t, and pin, v, arranged as described.

359. CORN SHELLERS; Charles W. Carter, Westville, Indiana, Assignor to Lester L. Bond and George Coatsworth, Chicago, Illinois.

Claim—The sectional truncated cone, constructed with the pintle, guide spring, and hinge, and arranged to operate in combination with the outer cone, in the manner specified.

360. MACHINE FOR PREPARING MOULDINGS FOR PICTURE FRAMES; Eleazer Gardner, Assignor to Gardner & Decker, City of New York.

Claim—The revolving rollers, arranged as described, in combination with the scraper, for the purpose specified.

361. RETORTS FOR DISTILLING COAL OIL; Joseph E. Holmes, Newark, Ohio, Assignor to self and Joseph Palmer, City of New York.

Claim—1st, The combination with the internal vapor pipe of a leg, so applied as to keep the mouth of the said pipe in the upper part of the retort, either by the direct action upon it of the force of gravitation, or by its dragging in the coal or other matter in the lower part of the retort. 2d, The arrangement of the steam pipe to communicate through the hollow journal, with a passage in the leg of the vapor pipe, for the admission of steam directly into and among the charge.

362. CAMERA STANDS; Henry J. Lewis, Brooklyn, New York, Assignor to self and Richard A. Lewis, City of New York.

Claim—The combination of the braces and screw clamping blocks, or their equivalents, with the legs, in the manner specified.

363. MILK PAN; E. L. Pratt, Assignor to self and R. B. Fitts, Philadelphia, Pennsylvania.

Claim—A pan with a detachable or hinged cover, forming, when combined, a vessel closed, with the exception of a series of minute perforations below for the access of cold air, and a suitable distance above the latter, another series of perforations for the exit of warm air and gases, and otherwise constructed as set forth.

364. SEEDING MACHINES; Alonzo R. Root, Assignor to Rufus S. Rickey, Keokuk, Iowa.

Claim—1st, In combination with the hopper and the revolving tubes or arms, the regulator, constructed as described. 2d, In combination with the regulator and revolving tubes or arms, the vertical and inclined partitions and lip, for the purpose of directing the seed to be sown from the hopper to the openings in the arms or tubes, and to prevent the seed from escaping unduly through the arm or tube, for the time being, immediately under the lamp.

365. GRINDING MILLS; George Selser, Assignor to self, J., and W. Cook, Philadelphia, Pennsylvania.

Claim—Attaching the hollow steel burr to the spindle, by screwing or otherwise securing the end of the latter to a plate, which is fitted snugly to the inside of the burr and shoulder on the spindle bearing on the top of the burr, as set forth.

366. MARINE PROPELLER; John Taggart, Roxbury, Assignor to self and George R. Sampson, Brookline, Mass.

Claim—The conjoint action of two separate rotary or screw propellers, respectively operating or screwing into the water and air, arranged as described, and propelled by a steam engine or motor within or carried by the vessel. Also, arranging the air screw propeller on its axis, at an inclination upward from the keel or plane of flotation of the vessel, in order that the said propeller, while being rotated, may operate, not only to draw the vessel ahead, but to lift her bow more or less out of water.

367. GAS RETORTS; Davis L. Weatherhead, Assignor to self and S. E. Southland, Philadelphia, Pennsylvania.

Claim—The cap with its box or reservoir when arranged in respect to the lower chamber, the upper chamber, and exit pipe of the retort, as set forth.

368. SAW-SET; Olive Ann Brooks, Great Falls, New York, administratrix of the estate of Lebbeus Brooks, deceased, late of Great Falls, aforesaid.

Claim—The arrangement and application of the benders and bending screw together, and with respect to the two handles, as set forth, whereby the centre of motion of the benders is at the place of contact, or the vertex of the angle of their upper surfaces, and no fulcrum pin is employed for the support and connexion of the levers.

ADDITIONAL IMPROVEMENTS.

1. TOOLS FOR TENONING SPOKES; J. J. Croy, Caledonia, Missouri; patented February 3, 1857; additional dated March 1, 1859.

Claim—1st, The adjustable gauge attached to the tube, as set forth. 2d, The employment or use of the temper or set-screws applied to the tube, as set forth. 3d, The gauges, H, fitted in the bars of the clamp cutter head, arranged as specified.

2. LOCKS; H. W. Covert, Assignor to M. Briggs, Rochester, New York; additional dated March 1, 1859.

Claim—The combination of the disc and centre, toothed or corrugated, as represented, for the purpose of

fastening them securely together; but I do not confine myself to any particular size, or shape, or number of teeth, nor to any particular position on the disc or centre.

3. FLY-TRAP; Wm. Riley, Madison, Miss.; patented April 27, 1858; additional dated March 1, 1859.

Claim—The cover or shade, the rim or front, and the pan, as described.

4. BEDSTEAD FASTENING; Oliver Robinson, Rochester, New York; patented December 28, 1858; additional dated March 22, 1859.

Claim—Constructing the locking bolt of a flat or rectangular form, so as to work against the surface of the side-board, to obviate the reducing of the bearing surface of the recess of the wrench, and hold the parts to the required position without the usual guide pin. Also, elevating the hooks above a right line through the centre of the bolt. Also, uniting the point of the circular wedge with the stock of the wrench, whereby greater strength and a better adaptation to the recess or seat of the same is secured. Further, adapting the cam or raised part of the wrench lever to pushing and holding forward the bolt for ready connexion with the pin.

5. RAILROAD CAR STOVES; James Spear, Philadelphia, Pennsylvania; patented June 1, 1858; additional dated March 22, 1859.

Claim—The combination of the openings in the side plate with the back fire-plate in connecting tube, with the centre plates, constructed in the manner set forth. Also, the openings in side plate with the centre plate, constructed in the manner set forth. Also, the flue or opening from the front plate to the top plate, constructed in the manner set forth.

6. COOKING STOVES; James Spear, Philadelphia, Pennsylvania; patented July 7, 1857; additional dated March 22, 1859.

Claim—1st, The combination of the cone damper with the smoke-pipe and the top plate. 2d, The combination of the head or deck collar with the cold air pipe and the smoke-pipe, constructed in the manner set forth.

7. MACHINE FOR MAKING AXES; Jonas Simmons, Cohoes, New York; patented March 1, 1853; additional dated March 22, 1859.

Claim—The groove, the arm, with the ton, in combination with each other in the manner set forth.

RE-ISSUES.

1. WINDOW FASTENER; C. R. Edwards, Niagara City, New York; patented July 8, 1856; re-issued March 1, 1859.

Claim—The employment of a single shaft, operated internally, and operating externally upon a window blind, when said shaft is made to effect the double purpose of operating both the blind and its slats, and this whether I construct and arrange the hinge and levers in the manner specified or not.

2. GRINDING MILL; G. Sanford, Poughkeepsie, New York; patented March 9, 1858; re-issued March 1, 1859.

Claim—Constructing a grinding mill with flat plates dressed on both sides, having a longitudinal reciprocating, vertical, and oscillating motion, in combination with flat stationary plates likewise dressed on both sides, the whole constructed and operated as described. Also, the notched form of the upper edges of the plates, for the purpose of preventing the mill from choking and to facilitate the feeding of the article to be ground between the grinding surfaces.

3. HANDLES FOR TABLE CUTLERY; J. W. Gardner, Shelburne Falls, Massachusetts; patented February 1, 1859; re-issued March 8, 1859.

Claim—Forming the handle of two parts which are encompassed at their junction by a ferule, the tang passing through both parts of the handle and the parts being secured thereon by a nut or washer or a rivet.

4. MACHINERY FOR PREPARING OVAL PICTURES; Wm. Gardner, City of New York; patented August 17, 1858; re-issued March 15, 1859.

Claim—A lathe with a face plate revolving in an oval path, in combination with a scraper adapted to the form of the desired moulding of the oval frame, when the said scraper is so arranged as to be self-adjusting laterally with the said moulding.

5. HARVESTING MACHINES; W. A. Kirly, Buffalo, New York; patented September 2, 1856; re-issued March 15, 1859.

Claim—The combination of the single plate and main wheel. Also, the combination of the main wheel, single plate, and rim, when connected together and operating in the manner set forth. Also, placing the vibrating wheel on the outside of the frame, or so that the outside of the frame does not bear on the outside of the wheel, in combination with the triangular-shaped frame on the inside of the wheel. Also, hanging the seat to the plate and to the standard, in the manner set forth. Also, a hinged lever seat and outside stirrup or supporter, in combination with a wheel having no outside frame or support.

6. MACHINERY FOR ENAMELING MOULDINGS, &c.; Robert Marcher, Cornwall, New York; patented October 21, 1858; re-issued March 15, 1859.

Claim—The employment of a plate whose lower edge is formed the reverse of the transverse form of the moulding to which it is applied, when such plate is made self-adapting to the surface of the molding during the longitudinal movement. Also, the employment of a hopper to contain the composition for enameling when the lower edges of the end plates thereof are formed the reverse of the transverse form of the moulding, and the moulding to be enameled is employed as the bottom of such hopper.

7. AMALGAMATOR; Lewis Solomon, City of New York; patented December 7, 1858; re-issued March 15, 1859.

Claim—1st, The use of elongated amalgamating chambers, when arranged in the manner specified. 2d, The arrangement of the amalgamating chambers within a heated chamber.

8. STEAM GAUGES; Thomas Stubblefield, Columbus, Ga.; patented July 18, 1854; re-issued March 15, 1859.

Claim—The combination of a case perforated at both ends with a spring valve, the spring forming the sides of the valve being arranged so as to cut off communication between the perforations in the opposite ends of the case, and perform the duty of a manometer spring, as described.

9. SMELTING FURNACE; Charles C. Alger, Newburgh, New York; patented June 30, 1857; re-issued March 29, 1859.

Claim—Constructing furnaces with the hearth and boshes of an elliptical or elongated form, in combination with the application of the blast at the sides, so arranged as to introduce the blast in the direction of the

breadth, and for the purposes specified. Also, in combination with the hearth and boshes made of an elliptical or elongated form, the construction of such furnaces with two mouths, one at each end, for working and tapping, as specified.

10. RECLINING CHAIRS FOR RAILROAD CARS AND OTHER USES; Isaac L. Devoe, Staten Island, New York, Assignee through mesne-assignment of Samuel M. Perry, City of New York; patented July 27, 1852; re-issued March 29, 1859.

Claim—1st, To so combine the back with the two end frames by means of bars jointed to it by one or two studs and one or two series of notches, or equivalents therefor, that the said back, when not a reversible one, may be raised and inclined in various positions, so as to not only support the back, but the head of a person at the same time. 2d, Making the back reversible by means of two series of notches and two sets of studs, or equivalents, arranged on opposite sides of the chair, and made to operate as specified. 3d, The improvement of making each arm or bar with a rack or racks of teeth or succession of notches, or equivalents therefor, for the purpose of adjusting and securing the backs in the desired position, whereby the occupant can alter or vary said position without rising from the seat.

DESIGNS.

1. STEREOSCOPE CASE; Alex Beckers, City of New York; dated March 1, 1859.

2. TABLE BELLS; H. C. Foote, Wallingford, Connecticut; dated March 8, 1859.

3. PARLOR COOKING STOVE; David Hathaway, Assignor to Fuller, Warren & Co., Troy, New York: dated March 22, 1859.

4. COOKING STOVE; A. C. Barston, Providence, Rhode Island; dated March 22, 1859.

5. HAT-BACKS; Edward Reynolds, Assignor to Thomas W. Brown, Boston, Massachusetts; dated March 29, 1859.

APRIL 5.

1. ARRANGEMENT FOR EXTINGUISHING FIRES IN STEAM VESSELS; Wm. Arthur, Brooklyn, New York.

Claim—The application of the waste water discharged from the air-pump raised to such height as to flood the steam vessel with water for the purpose of extinguishing fire, instead of discharging it, as usual, as waste water from the sides of the vessel.

2. MACHINE FOR WRINGING CLOTHES; S. A. Bailey, New London, Connecticut.

Claim—The employment of the cylindrical wooden spring piece, which is divided in two parts at its centre, each part being slotted from the place of division toward its outer end, the same being covered by a rubber cylinder.

3. CONDENSING COVERS; Abel H. Bartlett, Spuyten Duyvil, New York.

Claim—The reservoir and the pipes, when made and arranged as specified.

4. APPARATUS FOR EXHIBITING STEREOSCOPIC PICTURES; Alex. Beckers, City of New York.

Claim—1st, Placing the endless belt, chain, band, or apron, in such a position as to form an acute or obtuse angle with the base of the box or chamber of the apparatus. 2d, Placing the slides or frames holding the pictures in such a position as to form acute or obtuse angles with the endless belt or with the line of motion.

5. METALLIC PISTON PACKING; Asa G. Bill, Cuyahoga Falls, Ohio.

Claim—The arrangement of the arms on the central hub of the piston, which act on a ring, and which are operated by means of a cam.

6. REEFING SAILS; Robert B. Benson, City of New York.

Claim—Reefing the sail from the deck by the use of a supplementary foot-rope, or its equivalent, in combination with the auxiliary sheet and with the reefing lines.

7. GAS BURNERS; Wm. Blake, Boston, Massachusetts.

Claim—The arrangement of one or more conduit tubes in the burner or jet chamber, and with respect to the base of the said burner or jet chamber and its inlet passage or passages. And in combination with the arrangement of the inlet conduit or conduits, in such manner as to cause the gas to pass around in the expansion jet chamber in one or more helical currents, I claim an annular or ring exit orifice, whereby the current or currents of gas may be thrown out of the burner in one or more helical streams, so as to equalize the height of the flame and prevent it from flickering.

8. LIFE-BOAT; Mannervillette E. D. Brown, Utica, New York.

Claim—The construction of a life-boat with three recesses, as set forth. Also, in combination with the foregoing, the making a groove in the rudder iron, and a peg in the rudder bolt, for the purpose set forth.

9. PUMPS; Wm. R. Brown, Cleveland, Ohio.

Claim—1st, The bi-cuspid valve, constructed as described. 2d, The arrangement of the bi-cuspid valve, in connexion with the oscillating pump.

10. HYDRANTS; Joel Bryant, Brooklyn, New York.

Claim—1st, In the construction and use of hydrants, the shaft (whether hollow or solid, naked or encased), when used for obtaining water, as described. 2d, In connexion with the said shaft, the perforated open top and banded chamber valve, constructed as described.

11. PAPER-FOLDING MACHINES; Cyrus Chambers, Jr., Philadelphia, Pennsylvania.

Claim—1st, The register pins, so constructed and so attached to a paper-folding machine that they shall retain a position proper for the adjustment of the sheet, and yield by the movement of the latter. 2d, Adjusting one of the register pins laterally and longitudinally, independently of the other pin, by means of the slides, or their equivalents. 3d, Adjusting both pins simultaneously, both laterally and longitudinally, by the frames, X and Y, or their equivalents, the frame X, being adjustable in one direction on the frame Y, and the latter, together with the frame X, being adjustable in another direction on the frame of the machine, or any attachment thereto. 4th, Any convenient number of rods terminating at one of the folding rollers, the ends of the rods passing into grooves in the said rollers, for the purpose specified. 5th, The adjustable stop with its inner edge of a curved or angular form, or otherwise so constructed, that the end of the folded edge

only of the sheet shall be in contact with the said stop, for the purpose specified. 6th, The plunger with its adjustable plate, 8, in combination with the adjustable plate, 9, the said plate being arranged substantially as set forth. 7th, The curved wires, or their equivalents, attached to the machine in any convenient manner, situated under the folding apparatus and adjacent to the trough, for the purpose specified. 8th, The combination of an alarm or indicating apparatus with a paper-folding machine, when the said indicator is operated by a sheet folded by the machine. 9th, Causing the sliding board to move along the trough with a diminution of friction as the folded sheets accumulate, by means of the springs attached to the said board and arranged to bear against the wedge-formed or inclined strips, 5, as set forth.

12. POWER LOOMS; Wm. H. Cheetham, Jr., City of New York.

Claim—1st, The employment of a frame to contain the shuttles which are inoperative, which is constructed to hold the said shuttles, arranged in proper order, in two tiers, and is applied in such a manner in front of either or each set of shuttle-boxes of the loom, as to be capable of receiving in one tier the shuttles which are required to be thrown out of operation, and of supplying from the other tier the proper shuttles to take their places. 2d, The box, M, applied and operating in combination with the shuttle frame. 3d, The pushers, applied and operating in combination with the shuttle frame and box, as described.

13. PUMPS; John B. Christian and Abner Beeler, Mount Carroll, Illinois.

Claim—The construction, arrangement, and combination of the pumping cylinders, G G, and cylinders, B B and I I, in the manner specified.

14. VALVE ARRANGEMENT OF STEAM ENGINES; Henry Clayton, Tamaqua, Pennsylvania.

Claim—1st, The employment, in combination with a slide valve, of one or more shutters applied and secured thereto to vary and regulate the area of opening of the port or ports. 2d, Combining the two shutters (when two are employed,) with the slide valve, by means of two screws, one of whose stems passes through the other, which turns in a bearing on the back of the valve, and both of which stems pass through one end of the valve chest. 3d, The valve with its screwed stem, or its equivalent, and spring, arranged and applied as described.

15. POLISHING RICE; Levi H. Colburn, Baltimore, Maryland.

Claim—The process of breaking the outer covering and moistening the inner coating of rice, and polishing the same, as set forth.

16. STEAM ENGINES; Jacob A. Conover, City of New York.

Claim—Combining with the mechanism which connects the governor with the throttle valve, to regulate the admission of steam to the engine, a mechanism which disconnects the throttle from the governor to permit it to be closed by an independent power, to shut off the steam from the engine, as described.

17. SHOE PEG MACHINE; Caleb Cook, Stittsborough, New Hampshire.

Claim—1st, The discs, as described. 2d, The method of holding the peg-wood together by the chain and drum, and friction appliance. 3d, The method of holding the peg-wood firmly in place by pressing it up against the guide-piece, D, by means of the spring, and the lever and posts. 4th, The method of relieving the upward pressure against D, for the purposes of the feed motion by means of the system of levers, as described.

18. MOLE PLOUGHS; Jacob Creamer and Thomas W. Ricards, London, Ohio.

Claim—The arrangement of the beam, screw, wheel, and shaft, upon the sliding shoe, constructed as described.

19. PUMP; James E. Cronk, Poughkeepsie, New York.

Claim—The peculiar form and arrangement of the diaphragms with the shells, as described, and the ring forming a chamber between them, with the discharge therefrom.

20. MANUFACTURE OF ARTIFICIAL LEATHER; Ephraim and John R. Cushman, Amherst, Massachusetts.

Claim—1st, Holding the felt up to the roll, for the purpose set forth. 2d, Removing the adhering fibres from the surfaces of the felt before it reaches the felt washer, by means of the scratcher, or its equivalent.

21. ICE-PITCHER; Charles Dickinson and Wm. Bellamy, Newark, New Jersey.

Claim—An ice-pitcher provided between its walls with a hard non-conductor, so as to prevent the walls from indentation or fracture from within or without, while it also assists refrigeration, as described.

22. GRATE BARS; James Easterly, Albany, New York.

Claim—The corrugated grate bar, constructed in the manner specified.

23. STEAM BOILERS; E. M. Ivens, New Orleans, Louisiana.

Claim—The arrangement of a cylindrical or annular water drum (having a forced circulation) within the flue of an ordinary flue boiler, in the manner set forth.

24. BOOT-TREES; Winthrop B. Fay and Russell W. Collier, Upton, Massachusetts.

Claim—The elastic plates attached to the sides of the foot-piece in connexion with the adjustable bars, arranged as set forth.

25. BILLIARD TABLE; Fritz Fedderke, City of New York.

Claim—Constructing a billiard which may be changed from an American into a French billiard, by effecting a perfect continuation of the cushion throughout the whole length of the same, by means of cushion pieces inserted between and fastened to the jaws by a handle operating upon a fork lever, latches, or bolts, and springs, and re-converting the French billiard thus formed into an American billiard by renewing the said cushion pieces by the same means.

26. WATER-WHEELS; Josiah B. Fitch, City of New York.

Claim—The combination of the wheels, one or more, and gate, arranged relatively with each other and placed within a proper case, which is fitted within a penstock or flume, as set forth.

27. CLOTHES FRAME; H. M. Fletcher, Newport, New Hampshire.

Claim—1st, The plank, A, in combination with the plank, B, the bearings, and the sectional shafts, constructed as described. 2d, The sectional shaft, constructed and operating as described. 3d, The reel frame composed of the parts, in combination with the sectional shaft, the plank, A, the plank, B, the bearings, with their corresponding mortises, the spring, the pulley, and the cord, constructed as described.

28. MECHANISM FOR OBTAINING ROTARY MOTION FROM RECIPROCATING RECTILINEAR MOTION; Alvin K. Gilmore, Bath, Maine.

Claim—The combination of the bifurcated slider, two pulley sectors, their double pawls, or mechanical

equivalents therefor, and the wheel, the whole applied to one shaft, and made to operate in manner set forth. Also, in combination with the pawls and their disc wheels, the disc-moving mechanism, consisting of the levers, bent arms, sliders, forked arms, slide rod, and shifting lever, arranged as explained. Also, in combination with each double pawl and the shaft, a disc or wheel having studs or stops, and being applied to the shaft and friction wheel, as described.

29. FIRE ESCAPE; J. M. Hancock, Lansing, Iowa.

Claim—The flying pinions, in combination with the detent, the driving wheel, the spring-brake, and block brake, as described. Also, in combination with the described piece of mechanism, the table, or its equivalent, as described.

30. SHIP PROPELLING APPARATUS; A. E. Harding, Middletown, Ohio.

Claim—1st, The rollers, arranged as described. 2d, The arrangement and combination of the propeller chambers, B B, air tubes, openings, chambers, E E, pistons, gates, pipe, and propellers, arranged as described.

31. STUMP EXTRACTOR; G. D. Harris, Fitchburg, Massachusetts.

Claim—A stump puller having a pulley and two conical shafts, one shaft for winding the chain with a variable speed, the other shaft for correspondingly winding the rope, and otherwise constructed as described.

32. RENDERING FRICTION MATCHES WATER-PROOF; L. J. Henry, Assignor to Daniel Benrimo, City of N. York.

Claim—Rendering friction matches partially or entirely water-proof by the application of the melted coating, in the manner specified.

33. ROTARY ENGINE; Daniel Hughes, Rochester, New York.

Claim—The oscillating shoes, applied and operating in combination with the oscillating abutments and the rotating piston hub, as described. Also, the discs, having openings and sockets, applied in combination with the rotary piston hub, the cylinder heads, and the main shaft, as described.

34. TREATMENT OF PEAT FOR COMPOSTING; J. Burrows Hyde, Newark, New Jersey.

Claim—The use of peaty matter as a basis for admixture with other richer manures, when said peaty matter shall have been dried and finely powdered, previous to admixture.

35. ROTATING SHOT AND SHELLS; J. B. Hyde, Newark, New Jersey.

Claim—The use of tangential holes, bored from the outer surface into the solid portion of the front end of the shot, for receiving the rotating composition. Also, the use of the adjustable tubes or cases of rotating composition.

36. MOULDS FOR FORMING ARTIFICIAL TEETH; A. Lewenberg, City of New York.

Claim—A divided socket or holder receiving the pins of artificial teeth, so fitted as to be removable from said pins prior to taking the teeth out of the mould, for the purposes specified.

37. EXTENSION TABLES; Anthony Isky, Lancaster, Pennsylvania.

Claim—The arrangement of the pivoted cross slats affixed on each side of the central partition in the table frame and the double wings, when hinged, so that the wing may be turned over on to the slats, when extended, as also the adjustment and combination of the several parts described.

38. TANNING; Hiram Johnson, Farmersville, New York.

Claim—The use of a solution of quick lime as a tanning ingredient to be used in connexion with any of the tannic acids or tanning ingredients now in general use, not confining myself, however, to the exact proportions specified.

39. LATHE CLUTCH; Wm. Johnson, Lambertville, New Jersey.

Claim—The combination of toothed wheels and arms, actuated by a single screw shaft, so as always to present three several points of pressure centrally upon the body to be turned or wrought.

40. METALLIC COTTON BANDS; Richard Lewis, Charleston, South Carolina.

Claim—In the device, plates, A B, with slots, projections, opening, legs, and shoulders, in combination, constructed in the manner described.

41. METALLIC COTTON BANDS; Richard Lewis, Charleston, South Carolina.

Claim—The plates, A B, opening, projections, and shoulders, in combination, constructed as described.

42. MODE OF ATTACHING HORSES TO VEHICLES; E. D. Lockwood, Penfield, New York.

Claim—Attaching the strap to the thills, by means of the perforated plate and the pins placed in the recesses of the thills, and having wide and narrow parts, as described.

43. WATER-TIGHT DOORS FOR MARINE SAFES, LOCKERS, &c.; M. Ludlam, Fair Haven, Vermont.

Claim—The double door, constructed and operating in combination with the outer or surrounding frame work, and independent interior frame, or its equivalent.

44. REFRIGERATORS; Jacob Marx, City of New York.

Claim—The combination and arrangement of ice chamber, the gutter, pipe, the water-tank, and provision chamber, as specified.

45. INDIA RUBBER SOLES FOR BOOTS AND SHOES; Charles McBurney, Roxbury, Massachusetts.

Claim—A sole made of vulcanized india rubber, and having the holes for the reception of the pegs formed in the mould in which it is vulcanized.

46. SANDALS; Wm. McConnell, Philadelphia, Pennsylvania.

Claim—A sandal consisting of three blocks of wood, or other suitable material, attached to an elastic metal strip, when the said blocks are so situated in respect to each other, that one shall coincide with the toes, the other with the ball, and the third with the heel of the wearer's foot, as specified.

47. SEEDING MACHINES; O. H. Melendy, Delhi, Iowa.

Claim—The levers, slides, and projections on the wheel, in connexion with the bars connected by the links, arranged as set forth.

48. STEAM BOILERS; Gregor Menzel, Milwaukie, Wisconsin.

Claim—The arrangement in an upright cylindrical boiler of a fire-box and series of ascending tubes, a smoke-box, a single or double circle of descending tubes, a flue, H, and flue, I, in combination with jacket, with or without horizontal steam dome. I do not claim, irrespective, a circulation pipe for an upright boiler. But I claim the arrangement of my circulation pipes which hang loose and inside the cylinder, openings, and steam dome, in the manner described.

49. LAMPS; A. H. North, Hartford, Connecticut.

Claim—The rotating plate with the elongated scroll teeth, in combination with the vertical gears and the vertical actuating gear, in the manner described.

50. MACHINE FOR MAKING PATTERNS FOR COG-WHEELS, &c.; Washington Obenchain, Logansport, Indiana.

Claim—1st, The mode of adjusting the arm vertically by means of a screw, in combination with the upright, which is also adjustable about a vertical axis. 2d, The track frame when adjustable laterally for the purpose of giving taper to the piece cut. 3d, The arrangement and devices for adjusting the cutter.

51. PUMPS; J. K. O'Neil, Kingston, New York.

Claim—The combination and arrangement of the vibratory arm, rod, stem, guide, and spring, for controlling the valve from the top of the well, as described. Also, constructing the pistons with raised rims and guiding edges upon the heads thereof, in combination with the packing, coiled springs, and central disc, arranged in the manner set forth.

52. ROPE MACHINERY; J. W. Peer, Troy, New York.

Claim—Conducting the strands from their bobbins round the exterior of one side of the flyer, and from thence over guide rods, or their equivalents, to and through a hole or guide on the opposite side of the flyer.

53. PENCIL CASES; D. A. Peirce, East Greenwich, Rhode Island.

Claim—Constructing the end of the tube with a screw-thread, and forming the row of teeth therein, in the manner described.

54. ARRANGEMENT OF MACHINERY FOR OPERATING CORN SHELLERS SEPARATELY OR JOINTLY WITH A FAN OR CUTTERS; W. L. Potter, Clifton Park, New York.

Claim—The arrangement of the fan and the gearing in relation to the shafts, so as to connect and disconnect the same, for the purpose of allowing either the fan or the cutting apparatus to be operated with the sheller, or the sheller to be worked independently of either.

55. PUMP; John Powers, City of New York.

Claim—Arranging two forcing valvular pistons back to back in line with each other, and combining them by means of a piston rod, or other connexion common to both, with the arm of the brake at a point between the two pistons, so that both may be operated by the same arm of the pump brake. Also, combining the pump brake with the duplex pump barrel, by means of an air vessel, constructed and located so that it forms a secure fulcrum for the brake, and affords a passage through it for the arm of the brake to the piston rod upon which it acts.

56. STEAM BOILERS; Samuel Pierce, Troy, New York.

Claim—The employment of air tubes placed within the fire chamber of a steam boiler, in combination with the surrounding water tubes connected at both ends with the water spaces of the boiler, and connected with the inner air tubes by means of hollow stay-bolts, when the air and water tubes so combined are arranged as specified.

57. MACHINERY FOR LAYING ROPE; G. W. Pitman and W. C. Boone, Bushwick, New York.

Claim—The laying and unlaying of the strands to forward the twist, as described. Also, the ring guide, applied in combination with the bobbin to the nearest flyer, as set forth.

58. CHEESE CUTTER; T. H. Pollock and Daniel Bliven, Greenville, Connecticut.

Claim—The platform being provided with a rim and with projection, in combination with the turn-table, or its equivalent, to operate as specified. Also, the arrangement of the knife, the cutting edge of which makes an obtuse angle with the rack to which it is attached, and operates in combination with slots, in the manner specified.

59. RAIL-SPLICING CHAIRS; R. S. Potter, Chicago, Illinois.

Claim—A clamp wedge operated by the same bolts as a clamp and as a wedge acting upon each rail equally, in combination with the chair guard.

60. MACHINE FOR POINTING AND SPLITTING SHOE-PEGS; Jesse Reed, Marshfield, Massachusetts.

Claim—1st, A traversing carriage, in combination with a revolving table, so arranged that after a series of cuts has been made in one direction, the table may be revolved 90 degrees preparatory to making the second series of cuts. 2d, The device for traversing and returning the carriage, consisting of the following parts, or their substantial equivalents, in combination, viz: the screw shafts, the block, the lever, with its spring and tripping arrangement. 3d, The device for automatically revolving the table, consisting of the spring and the parts, m n o p and k, or their equivalents. 4th, The grooving and splitting irons traversing the block, in combination with the holders, or their equivalents. 5th, Feeding the block by means of the continuous revolution of a screw operating through a spring, so that when the block is released the feed is instantly given to it, in the manner set forth.

61. KEEPING AIR-SPRINGS SUPPLIED WITH AIR; S. G. Randall, Middlebury, Vermont.

Claim—Combining an air-spring and an air-pump, or its equivalent, with a car or carriage, or other moving conveyance, so that the motion of said car, carriage, or other conveyance, shall through such air supplier keep the air-springs supplied with air.

62. AIR ENGINES; B. F. Rice, Clinton, Massachusetts.

Claim—Giving to the plungers or piston of air engines a rotary motion, for the reasons specified. Also, giving to the plungers or pistons of air engines a rotary motion, in combination with the means employed for keeping the entire surfaces of the plungers or pistons continually lubricated, in the manner set forth.

63. BANDS FOR BINDING GRAIN, HEMP, &c.; Andrew Ralston, West Middletown, Pennsylvania.

Claim—Furnishing cords or straps used for binding grain, hemp, &c., &c., with a T-shaped clasp, as described.

64. CAR COUPLINGS; J. C. Ransier, Lyons, New York.

Claim—1st, Clevis, B, in connexion with fulcrum, E, key-bolt, D, for the purpose of a connecting link between railroad cars, so constructed and arranged that said clevis or link will encircle and revolve up and down, and sway to the right and left over the outside of bumper plate or plates and the body of the bumper, and otherwise arranged as described. 2d, Revolving arms, or their equivalents, in combination with the dog, for the purpose of aiding in casting off the opposite clevis from the hook, in the process of disconnecting or uncoupling; also, for a rest for, and in aiding in, throwing clevis on the same bumper forward from its upright

position in the process of effecting a coupling. 3d, Hook, c, or its mechanical equivalent, placed on top of the upper bar, and in rear of the top shoulder of fulcrum, for the purpose of receiving the curved point of the opposite clevis in the process of coupling. I do not intend to confine myself to rod or shaft for the purpose of turning dog, o, against the shoulder of arms, for the purpose of raising the points of said arms, in the process of casting off the opposite clevis in the process of uncoupling, as described, as other well known modes of screw or lever power can be employed with equal effect.

65. CAPSTAN; Jesse Reed, Marshfield, Massachusetts.

Claim—The adjustable detached fleeter, operating as set forth. Also, the employment of the double inclines, whereby I am enabled to fleet the cable, whatever may be the direction in which the capstan is turned.

66. PRINTERS TYPE CASE; T. N. Rooker, City of New York.

Claim—The method of arranging the compartments of a type case, that is to say, placing at the side of the lower case character its corresponding upper case character, for the purposes set forth.

67. PEGGING MACHINE; James and A. W. Sangster, Buffalo, New York.

Claim—1st, The combination of the wheels, P and Q, the ratchet, and the peg-wood, with the awl, peg-driver, the knife, and the shoulder, when arranged substantially in the manner specified. 2d, Placing the adjustable wheel in arrangement with those parts which form the subject of the first claim, for the purpose of regulating the distance at which the pegs are to be driven from the edge of the leather or material pegged.

68. MACHINE FOR MAKING HOES; Henry Sauerbier, Newark, New Jersey.

Claim—The cam lever and the dies, in combination with the lever, the loose pin, and the clamp, constructed in the manner specified.

69. UMBRELLAS; L. K. Selden, Haddam, Connecticut.

Claim—An umbrella or parasol, having its frame constructed of a rim and stretcher, formed of arms or bars, pivoted and connected together in connexion with the tube, E, and rod, F, arranged as described.

70. RUBBER-HEAD FOR LEAD PENCILS; W. W. Shaw, Troy, New York.

Claim—A head for lead pencils made of rubber, in the manner described.

71. BREECH-LOADING FIRE ARM; T. E. Shull, Millersburgh, Pennsylvania.

Claim—1st, The combination with a fire arm constructed with a stationary and closed breech or breech piece, and with an opening in the barrel to receive the cartridge, of a hinged flap door or lid which opens and closes the cartridge charging aperture. 2d, The combination with a hinged flap door or lid of a sliding collar or sleeve, so that the operation of sliding the collar back will open the flap door or lid, and the operation of moving it forward will close and lock the same, as set forth.

72. PORTFOLIO; H. T. Sisson, Providence, Rhode Island.

Claim—The combination of the barrel, shaft, hooks or teeth, a spring or springs, spring latch, and stop, constructed as set forth.

73. SIDE-WHEEL STEAMERS; A. M. Sprague, Mobile, Alabama.

Claim—Raising the after guards next adjacent to the wheel about the deck and hull of the boat, and also above the forward guard, so as to leave a clear water-way beneath the after guard and immediately abaft of the wheel, for the purposes set forth.

74. HARVESTERS; W. S. Stetson, Baltimore, Maryland.

Claim—Giving to the frame a back and forth motion upon the axle-tree, said frame supporting at its rear end the axis of the driving pinion, in the manner set forth. Also, the vibrating frame, connected with the rear end of the frame, and having its centre of motion coincident with the axis of pinion. Also, the combination of the shoe with the vibrating frame, by means of the hinge bolt, arranged and attached to the rear of said frame, in the manner set forth, by which combination the knife-bar is made self-adjustable. Also, connecting the adjusting lever with the platform and sliding frame, as set forth. Also, horsing the knife over the platform or in a position at right angles, or nearly so, to the axle by the two movements, substantially as described.

75. SYRUP-CHARGING APPARATUS; W. C. Turner, St. Louis, Missouri.

Claim—The construction of a machine, so arranged that a uniform and definite measure of any liquid may be supplied to a bottle, or any other vessel, before, during, or after filling the same with soda, mineral, or water surcharged with carbonic acid gas, or other gas, or any other liquid, by means of a pump air vessel, safety valve, charging valve, or charger, constructed and applied substantially as described.

76. COOKING RANGES; H. K. Stimpson, Boston, Massachusetts.

Claim—The combination of the flanches or projections attached to the side plates of the boiler chambers with the grate, constructed so as to admit air to the fuel from below, and hung so as to allow of its free play, and made narrower than the fire chamber, whereby the contraction and expansion of the grate is prevented from injuriously affecting the remaining portion of the range or stove. Also, the use of the sliding covers, in combination with the top plate, arranged as described.

77. MANUFACTURE OF RESIN SOAP; Stephen Strung, Birmingham, Pennsylvania.

Claim—The admixture, compounding, and preparing of the ingredients named, in proportions specified and for the purposes set forth.

78. MACHINE FOR DRESSING MILL-STONES; Samuel Teague, Newton, Ohio.

Claim—The adjustable braces when combined with the picks, sliding frame, and levers, constructed in the manner set forth.

79. MANUFACTURE OF IRON; Alfred Thomas, Howard Iron Works, Pennsylvania.

Claim—The mixing of charcoal and anthracite metal and forge cinder, in the proportion substantially as stated, and working them together in the puddling or boiling process, or in a refinery fire, for the purpose of making a superior quality of iron.

80. BEDSTEAD; Pelatiah Thompson, Springfield, Ohio.

Claim—The combination of the double series of helical springs with the removable holder strips and series of cross slats operating with their steadying pins. Also, in combination with the series of slats operating with a series of springs, as specified, and the removable holder strip, I claim the series of guiding blocks, when two or more are extended down to prevent the removable strips from jumping.

81. Machine for Jointing Staves; Jonathan Troop, Saintclairville, New York.

Claim—1st, The vibrating frame, F, provided with the clamp bars, h h, and stave-adjusting bars, m, and used in connexion with the gauge-screws, a', arranged for the purpose of properly presenting the staves to the cutters. 2d, The combination of the above named parts with the rotating cutter wheel arranged for joint operation, as set forth.

82. Machine for Cutting Soles for Boots and Shoes; Albert Warren, Jefferson, Ohio.

Claim—A series of pieces covering the bottom of the box, like c c, separated by a straight line through the centre, together with the series of pieces, like b c, with the knife held securely between their crooked edges, and arranged alternately with a toe to the right and left, and covered by the forms, in the manner described, when these devices are combined with the slide, arranged as specified.

83. Egg Pan; Nathaniel Waterman, Boston, Massachusetts.

Claim—The baking pan or arrangement of cups, and a handle at each end of the series, all connected together and cast or founded in one solid piece of metal and with heat passages between the cups.

84. Fastening Iron Bands on Cotton Bales; C. G. Wells, Galveston, Texas.

Claim—The application of the washer, and the mode of fastening the end of the band with it, and thus expediting the operation of baling and compressing bales of cotton or merchandize, and retaining them securely in their compressed form.

85. Valve Motion of Oscillating Steam Engines; G. D. West, Brandywine Hundred, Delaware, Assignor to P. W. J. Neifus, City of New York.

Claim—The combination of arch and lever, for the purpose as set forth.

86. Burnishing Machine; L. S. White, Waterbury, Connecticut.

Claim—1st, So applying two burnishers in a burnishing machine, that they shall operate simultaneously, at opposite points on opposite sides of the article or piece of work to be burnished, and burnish both sides at once; and that during such operation each shall serve to support the article or piece of work, against the pressure of the other. 2d, The combination of the reciprocating and partially rotating shaft and yoke, or their equivalent, and the tool stock, by means of the rods, s s, the arm, k, and rod, l, and arm, m. 3d, The sliding bars, applied in combination with the tool stock carriage, to operate as specified.

87. Variable Cut-off for Steam Engines; D. A. Woodbury, Rochester, New York.

Claim—The combination of the vibrating yoke attached to the valve stem, and the rotary cam or wiper wheel having arc-formed tappets or wipers, the whole being applied as set forth.

88. Method of Sawing Shingles from the Bolt; Wm. H. and George Yates, Chittenango, New York.

Claim—The adjustable bar and the carriage provided with the adjustable dog, connected with the hand lever, arranged as set forth.

89. Steam Engine; James Black, Philadelphia, Pennsylvania, Assignor to George M. and Wm. S. Worl, and said George M. Worl, Assignor to W. S. Worl, aforesaid.

Claim—The arrangement of the cylinder, hoops, and discs or wheels, when said discs are set eccentrically to an axle which pierces the cylinder transversely, and one end of the piston rod of the cylinder is connected with and operates the hoops.

90. Trace Fastening; Anthony Zink, Lancaster, Ohio.

Claim—The metal ferrule provided with a circular groove running in path of a vertical circle, and two slots running at right-angles to the groove, and a metal cap having two lugs on its inner circumference, with a space existing between them and its head, and a plate extending from the circumference of the head some distance into the side of the trace, as set forth.

91. Bedstead Fastening; Levi W. Buxton, Assignor to Josephus Baldwin and L. Kimball, Nashua, N. H.

Claim—The combination of the shoulders on the locking or rail piece, with the notched or serrated circular edges and conical pin. Also, the combination of the hook with the tube or friction roller and stationary pin.

92. Carpet Sweeper; Jacob Edson, Assignor to self and H. F. Gardner, Boston, Massachusetts.

Claim—1st, Holding the rubber tire upon the driving wheel by means of the groove formed in the said wheel, whereby I am enabled to use a cheaper form of soft or elastic tire than would otherwise be possible. 2d, The use of the flap or float, arranged for preventing the escape of dust and the wear of the brooms. 3d, Arranging two sets of brooms on their common shaft in such a manner that they shall cross each other diagonally. 4th, Holding the brooms upon their shaft by sectional adjustable clamps that reach by or overlap each other, whereby, while every portion of the brooms is securely held, they can be adjusted at pleasure or new ones inserted. 5th, Hanging the broom shaft in such a manner by means of the hinge or pivot joint and yielding spring, that the brooms will adapt themselves to any and all inequalities of the surface to be swept, and at the same time perform their work thoroughly.

93. Washing Machine; Wm. C. Grimes, Assignor to self and R. B. Fitts, Philadelphia, Pennsylvania.

Claim—The combined arrangement of the two parallel rock shafts, having the wash-boards attached thereto respectively, and connected together by the flexible apron, in combination with the double curved bottom of the box.

94. Portable Steam Generator; Wm. C. Grimes, Assignor to self and R. B. Fitts, Philadelphia, Penna.

Claim—1st, Making the three distinctively specified parts, consisting of the furnace, the boiler, with its external cylinder and float attached, and the reservoir, so as to be readily separated from each other, and readjustable together at any moment, in the manner and for the purpose set forth. 2d, Making the boiler self-supplying (with water), by means of the float and its containing cylinder, arranged in connexion with the boiler, as described, the same operating together in combination with the reservoir, as set forth. 3d, Making the furnace with an annular chamber between the fire cylinder, the outside shell, and the rings, when the same are constructed, arranged, and combined together, and with the other parts of the boiler, so as to cause the air which supports the combustion of the fuel in the said cylinder to pass down through the said annular chamber, before it enters the said fire cylinder, as described.

95. Pyrotechnic Night Signals; G. A. Lilliendahl, City of New York, Assignor to Martha J. Costan, Washington City, D. C.

Claim—1st, Enclosing the necessary charges of pyrotechnic composition for producing signal fires within cases whose sides are composed of thin paper and tin-foil. 2d, Separating the respective layers of composition in the above mentioned cases, by means of thin partitions or discs. 3d, Charging the aforesaid cases with

such proportions of combustible and non-combustible materials as will allow the cases to be all made of the same length, and also enable a socket to be formed at the lower end of each of said cases. 4th, So proportioning the paper and tin-foil portions of the aforesaid cases, that a sufficient portion of the tin-foil will project above the stiff sides of each of said cases, to form, when bent inwards, a metallic covering for the top of the same.

96. STEAM PRESSURE GAUGE; James H. Mosher, Assignor to self and Anson T. Colt, City of New York.

Claim—So applying the valves, in combination with each other, that the gauge may be charged while both legs are open to the atmosphere, and that the air above the mercury in the index tube may be caused to have an ordinary atmospheric pressure while the mercury is at zero, and there is only the pressure of the atmosphere on the back leg.

97. GAUGING DEVICE ATTACHED TO HAND SAWS; Wm. McNiece, Assignor to Walter Cresson, Conshohocken, Pennsylvania.

Claim—The back saw with the folding or adjustable blade fitted in its rib or back bar, as described.

98. MODE OF ATTACHING STRAPS TO BOOT LEGS, Julius A. Pickering, Assignor to William Walker, Milford, Massachusetts.

Claim—Supporting or retaining the loop or upper part of the strap, in the manner described.

99. FAUCETS; George W. Randall, Assignor to self and Reuben J. Todd, Boston, Massachusetts.

Claim—The combination of the auxiliary or inner tap with the outer tap and the conduit case, provided with two or more conduits, as described. Also, the arrangement of the air passage, so as to discharge with reference to the discharging end of the inner tap, as described.

100. SHIP-STEERING APPARATUS; D. J. Wilcoxson, Milan, Assignor to self and Isaac Collins, Huron, Ohio.

Claim—1st, The combination of the double yoke with the traversing nuts, arranged as described. 2d, Arranging the screws by which the rudder is turned on either side and below the top of the rudder post, so that, in case of accident, the tiller may be used to steer the vessel without its being interfered with by the steering mechanism.

101. HUB BORER; Cutting B. Wiley, Adrian, Assignor to self and Alex. Stebbins, Lenawee Co., Michigan.

Claim—The combination of the sliding cutter head with the adjustable ways or slides, with the nut and screw, as described.

102. PYROTECHNIC NIGHT SIGNALS; Martha J. Costan, Washington City, D. C., Administratrix of the estate of B. Franklin Costan, deceased.

Claim—The signalizing of any numeral, combination of numerals, or any character, or any combination of characters, by a methodical exhibition of different pyrotechnic fires, substantially as set forth.

APRIL 12.

103. MACHINE FOR NOTING THE SUMS OF NUMBERS ADDED; J. W. Arndt, Green Bay, Wisconsin.

Claim—The arrangement of three indexes on a dial marked with units, hundreds, and thousands, in combination with the swivel arm, the ratchet wheel, and with the pinions, and with the gear wheels, or their equivalents.

104. PROJECTILES FOR FIRE ARMS; Wm. H. Arnold, Washington City, D. C.

Claim—Combining with hollow base projectiles, a shaft split at its extremity, and otherwise constructed as described.

105. GAUGING THREADS; J. E. Atwood, Mansfield Centre, Connecticut.

Claim—A series of rollers, or other equivalent devices, so arranged that their surfaces combine to constitute a number of gauges through which the thread is conveyed, by suitable means, and by which its thickness is measured at two or more points at the same time, and a multiplied measurement is obtained.

[The object of this invention is to determine the size or thickness of threads, or of the several portions of a single thread, with a view to their being sorted according to their size, more especially for the sorting of silk thread preparatory to its being manufactured into sewing silk by the doubling, or trebling, and twisting process.

106. GAS REGULATORS; S. D. Baldwin, Milwaukie, Wisconsin.

Claim—1st, The annular recess or chamber, for the purpose stated. 2d, And in combination with a regulator having such recess, the union piece, as set forth.

107. SHUTTER OPERATOR; J. K. Barker, Lawrence, Massachusetts.

Claim—The use of the block or arc of convenient size to be fastened to the blind or building, as described. Also, arranging the pipes or cords, and opening, shutting, and fastening exterior blinds in the inside of buildings, by means described.

108. DOVETAIL JOINTS FOR WOOD, &c.; F. S. Barnard, City of New York.

Claim—The tongued and grooved sectional dovetail joint to connect wood or other material together, in substantially the manner specified.

109. STEREOSCOPE CASE; Alex. Beckers, City of New York.

Claim—1st, The picture frames, constructed of elastic wire, or of any other suitable substance, and provided with a hook for adjusting the pictures in the centre. 2d, The arms, arranged in such relation to the pictures, that by the motion of the arms each of the pictures, when brought before the eye-glasses, can be moved to and from the same, until it comes into the proper focus.

110. PUMP; A. Beeler and J. B. Christian, Mount Carroll, Illinois.

Claim—The combination of two sliding cylinders with each other and with a third stationary cylinder, arranged in the manner specified.

111. SELF-PRIMING GUN LOCK; F. Bell, Washington City, D. C.

Claim—The combination of mechanical devices, as described, with the slide, by means of which the latter can be either kept rigidly in position over the mouth of the magazine chamber, thus intercepting all communication with the latter, or be thrown in gear with the lock plate, so that by cocking the hammer it will be

operated in such manner as to force a cap from the magazine chamber into the discharge chamber of the hammer, on the descent of the latter upon the nipple.

112. GRAIN SEPARATOR; Jacob Benner, Alleghany, Pennsylvania.

Claim—1st, The arrangement of the receiving chamber, separating chamber, collecting chamber, and gathering chamber, when used in connexion with the suction fan. 2d, The arrangement of the shutes and valves, when used in connexion with the conical or convex bottom of the collecting chamber.

113. SMUT MACHINES; Jacob Benner, Alleghany, Pennsylvania.

Claim—1st, The use of plate, with the cone and the opening between the lattice work and plate, when used in connexion with the suction fan, the beaters on drum, and the flues, as described. 2d, The arrangement of the chambers, A B C and L, and the flues, in combination with suction fan, lattice work, opening, plate with cone, and beaters on drum, as described. 3d, The use of the straight or perpendicular part, X, with cap of the casing of chamber, A, for the purpose of forming an eddy in chamber, L, as described.

114. BREAD CUTTER; Hiram Berdan, City of New York.

Claim—The arrangement of the adjustable cavities, in combination with the cutting-off knife, and the large cylinder and piston, and the so connecting the several parts, that the amount of dough displaced by the piston shall be exactly equal to the cubic contents of the cavities presented for filling between each stroke of the cutting-off knife. Also, the devices for rounding up the loaves as they fall from the cavities, consisting of the grooved roller and shield, the roller having a vibratory motion, in the manner specified, in combination with the preceding arrangement of devices claimed.

115. ATTACHING THILLS TO VEHICLES; Douglas Bly, Rochester, New York.

Claim—The arrangement of the movable piece or block having the notch and screw shank in half, and slightly wedge-shaped, in combination with the oblique shoulder on the notched screw shank, and with the hook of the block, in the manner set forth.

116. DEVICE FOR DRAWING SAWDUST, &c., FROM STAVE MACHINES; Michael Brayer, Rochester, New York.

Claim—The employment or use of the levers, in combination with the inclined bed, arranged as set forth.

117. FASTENING FOR SHIRT STUDS; Barnes Clayton, Philadelphia, Pennsylvania.

Claim—The armed post, in combination with the cross-piece fixed to the stem of the front piece.

118. HARVESTERS; Levi H. Colburn, Baltimore, Maryland.

Claim—The spiral-revolving cutter, arranged with a continuous opening through its centre, for the purpose specified.

119. VARIABLE CUT-OFF FOR STEAM ENGINES; J. M. Colman, Milwaukie, Wisconsin.

Claim—Combining the double-seated, balanced, or equilibrium valve with the ordinary slide valve of steam engines, as set forth.

120. COTTON SEED PLANTERS; J. P. Crutcher, Silver Spring, Tennessee.

Claim—The rotating hollow chamber, in combination with the clearer and agitator, and swinging frame, as set forth.

121. HERNIAL TRUSSES; Josiah Danforth, Middletown, Connecticut.

Claim—Uniting by a screw or rivet the two springs, at a given point from the end of each, with pads attached, which can be adjusted to the body without any additional spring, and thereby making the arrangement and combination of the two springs, with their respective pads, a truss of itself.

122. CHURN; Edward L. Dorsey, Green Wood, Indiana.

Claim—The employment of the trundle wheel, staff, pitman, and cog-wheel, for the purpose of giving at the same time a vertical and a circular motion to the dashers for churning butter.

123. GUIDE ATTACHMENT FOR VEHICLES; Nathaniel Drake, Newton, New Jersey.

Claim—The slotted pole strap bar and catch, placed on and connected with the draft pole, in connexion with the cords attached to the catch, passing through the uprights and shieves of the horse collars, and attached to foot levers.

124. SEEDING MACHINES; John B. Duane, Schenectady, New York.

Claim—1st, The arrangement of the vibrating toothed board and agitating bar, connected by the lever, in connexion with the adjustable slide, and perforated bottom, and grooved roller. 2d, The roller when attached to the frame by the bent levers, and connected with the caster wheels through the medium of the bars, arranged as set forth.

125. ARTIFICIAL LIMBS; Richard R. Dutton, Philadelphia, Pennsylvania.

Claim—1st, The use of the hardened cylindrical tube in constructing joints for artificial limbs, substantially as described. 2d, The use of the feather spring, D, when arranged to operate as set forth. 3d, The use of the bolt and pulleys, when arranged for the purpose described. 4th, The use of the spring, G, when so constructed to act substantially as set forth.

126. OIL CANS FOR LUBRICATING; Thomas Fields, Media, Pennsylvania.

Claim—Attaching the oil can by means of a clamp to a handle, and using, in connexion therewith, the lever or bar actuated by the cord and slide.

127. GRAIN DRILLS; James Ford, Wabash, Indiana.

Claim—The arrangement of the seed-box, E, lever, N, rod, P, slide, S, lever, M, and tilting frame.

128. COVERS FOR TRAVELING TRUNKS; Eldridge Foster, Hartford, Connecticut.

Claim—The air-inflated trunk cover, in the manner set forth.

129. COFFEE-ROASTERS; Washington L. Gilroy, Philadelphia, Pennsylvania.

Claim—The arrangement of the two sets of the united staying and guiding pieces, B B and B′ B′, on the inner side of the said hollow sphere, each set being placed diametrically opposite to the other, and with their apexes in the direction of the rotary motion of the said sphere, that they may, in succession, operate in combination with the interior spherical curve of the latter, during its rotary motion, to remove the coffee from the middle of the bottom of the said sphere toward the ends thereof, and essentially permit it to fall gradually over the edges of the said staying and guiding pieces into the middle of the bottom again, as specified, thus rendering the said spherical coffee-roaster perfect in its operation, as described.

130. CALLIPERS; Fayette Gould, Huntington, New York.

Claim—In combination with the jaws and graduated bar, the dial plate, and index, the latter being actuated by the pinion and rack.

131. CHAIRS FOR RAILROAD BARS; Henry H. Graham, Paterson, New Jersey.

Claim—The horizontal binder and vertical wedge, in combination with the chair that receives and sustains the ends of the rails, in the manner described.

132. CARPET FASTENER; Marshall Granniss, Waterbury, Connecticut.

Claim—A carpet fastener composed of a plate provided with ears, and a fork or plate having prongs, as described.

133. JOINT-BODIED BUGGIES; Edwin J. Green, Valparaiso, Indiana.

Claim—Connecting the front axle of a carriage to the body by means of a swivel joint, composed of shaft, king-bolt, turning plate, and stationary plate, when the latter is secured directly to the body of the carriage. Also, connecting the front springs to the coupling or reach by means of the shaft, which is welded, or otherwise secured to said springs. Also, in combination with a hinged carriage body, the braces, for the purpose of preventing the rear axle from being thrown angling when the carriage is loaded heavier on one side than on the other.

134. MACHINE FOR THREADING SCREWS; Ira Griggs, Utica, New York, Assignor to the Utica Screw Manufacturing Company.

Claim—1st, So applying the rest and controlling it by a spring, as to provide for its longitudinal movement in, and independently of, the carriage. 2d, Fitting the cutter stock with an eccentric, operated by means substantially as described, to provide for it a movement for tapering the point of the screw, independent of the vibrating movement to feed the cutter, in cutting the other portion of the screw. 3d, And though I do not claim, broadly, a two-pointed cutter, I claim the construction of the cutter with two points, at such a distance apart as to straddle two turns of the thread and the intervening space.

135. MACHINE FOR NICHING HEADS OF SCREWS; Ira Griggs, Utica, New York, Assignor to the Utica Screw Manufacturing Company.

Claim—The arrangement of the holding dies and feeding slider in a carrier, which swings upon the same shaft which carries the cams for operating the said dies and slider, and operates in combination with the notching-saw. Also, the discharging of the notched blanks from the holding dies in a lateral direction, by the introduction of the new blanks into the said dies.

136. MACHINES FOR TAPERING STICKS; H. S. Hall, A. D. Hunt, and C. J. Winchester, Assignors to H. S. Hall, A. D. Hunt, and C. E. Jeffords, Jamestown, New York.

Claim—The rotating cylinder provided with the adjustable bearings and cutter, one or more, when said bearings and cutters are operated through the medium of the plate, bar, with inclined bar attached, and the rack and pinion, in connexion with the springs.

137. ELASTIC POLISHING-WHEEL; Loren Hale, Milford, Massachusetts.

Claim—The hollow elastic ring, operating as set forth.

138. STIRRUPS; Wm. J. Hammersley, Hartford, Connecticut.

Claim—In a saddle stirrup, the employment of the tube, spring, and spindle, for the purpose described.

139. BED-BOTTOM; H. P. Hart, New Woodstock, New York.

Claim—The arrangement of the springs, hooks, and rails or rods, in combination with each other, by which the turns of the hooks are made to form shoulders to support the springs against the pressure of the rods, when these are made to bear directly upon both ends of the springs.

140. PIERS OR BREAKWATERS; Charles T. Harvey, Marquette, Michigan.

Claim—The combination and arrangement of the adjustable bottom-fender or crib with the pier, constructed in the manner specified, the said fender being hinged or so applied to the pier as to be capable of adapting itself to the slope of the bottom in front of the vertical side of the pier, and of protecting the foundation of such pier from the corroding action of currents.

141. HORSE COLLARS; Thomas Harvey, Baltimore, Maryland.

Claim—The arrangement of the parts forming the body of a horse collar, and the construction of an underback, in such form as that the outer edges of the underback, and the face of the collar, and the outer back, are all made perfectly secure by an under seam, and at the same time the under seam is hid from view and wear, as also showing the stitched edge of the outer back in its proper place, all being accomplished previously to the filling of the collar, instead of putting on the outer back after the collar is filled, as in the manner in putting together a case collar.

142. HORSE COLLARS; Thomas Harvey, Baltimore, Maryland.

Claim—The construction and addition of a fancy welt to a welted horse collar, the same being perfectly adapted to its location, being alongside of the usual welt, and so formed as to bring it directly down on the face of the collar, and thus showing a stitched edge, as also being in the proper place to prevent the hametug from cutting into the collar.

143. SEWING MACHINES; Wm. Cleveland Hicks, Boston, Massachusetts.

Claim—1st, Transmitting the motion to the needle-stock from that cam or crank on the main shaft which drives the said stock, by means of a pinion interposed between the connecting rod and the needle-stock, and combining the two by rack-teeth cut on each, and meshing into said pinion, whereby I am enabled to impart to the needle-stock the precise motions of said cam or crank. 2d, Setting the feed-wheel or other feeding mechanism, and the shuttle-race, in such position beneath the sewing-table, that the direction in which the materials will be fed and sewed shall be in a line parallel with the bracket arm, and toward or into the bight formed by said arm and the table. 3d, The apparatus for giving out and taking up the slack of the thread, consisting of a partially revolving crank or arm, placed and operated as set forth.

144. ROTARY HARROWS; W. Y. Hildrup, Harrisburgh, Pennsylvania.

Claim—The arrangement of the bars, sliding piece, braces, and draft bar, for the purpose of giving two or more harrows a self-adjusting movement to or from each other.

145. LAMPS; Samuel A. Hill and David Alter, Freeport, Pennsylvania.

Claim—The arrangement and combination of the strip within the cap, as described.

[By this device combustion is retarded, and the fluid within the lamp, as it is converted into vapor by the

heat, is not instantly burned, but is allowed to absorb or become mixed with a requisite degree of oxygen to support combustion, and give a bright illuminating flame without a chimney.]

146. PLOUGHS; Wm. C. Holmes, Barnesville, Georgia.

Claim—The arrangement of the double beams, hook, cross adjustable braces, shanks, and braces. Also, in combination with the above, the seed dropper, constructed for operation conjointly, as set forth.

147. STOVE COVERS; Isaac G. Johnson, Spuyten Duyvel, New York.

Claim—The centre-piece, constructed of malleable cast iron, as specified.

148. KNAPSACKS; Wm. B. Johns, United States Army.

Claim—The construction of knapsacks, so as to be entirely separated from their slings, and with the means of uniting several of them together, and with stitching them, as described, so that the knapsack will perform the double function of sheltering the soldier and holding his kit.

149. BURNERS FOR VAPOR LAMPS; Henry Johnson, Washington City, D. C.

Claim—The generator, burner, and packing-box, constructed in combination with gas pipe and fluid pipe, arranged as described.

150. MACHINES FOR CHAMFERING SOLES OF BOOTS AND SHOES; Wm. Johnson, Hampstead, New Hampshire.

Claim—The chamfering tool with its sole rest and presser, arranged with respect to the carrier and the knife-holder, as specified.

151. MORTISING MACHINE; Wm. Kegg, Lassellsville, New York.

Claim—The method of feeding along the work, consisting, essentially, of the feeding wedge or wedges, combined with the arms or projections, sliding bolts, and adjustable cams, and arranged with the feeding table, frame, and sliding frame. Also, the adjustable stops and notches in the wedges, with their suspending hooks or staples, arranged in combination with the feeding apparatus. Also, the combination of the double scale, on the face of the feeding table, with the movable or adjustable pointer in the bed-piece. Also, the supporting index standard, in combination with the scale and arrangement for adjusting the bed-piece of the feeding table in position and securing it in place. Also, the "key-tenon," fitting into the oblique groove in the bottom of the feeding table, for the purpose of properly securing and tightening the said table on the bed-piece, while at the same time the desired freedom of its motion is allowed.

152. STOVES; Gilbert J. Kingsbury, Rochester, New York.

Claim—Constructing the fire-pot or furnace so that a portion thereof is flaring or funnel-shaped, yet having side-grates or bars, with perpendicular faces and flame passages, with air tubes, and jets, and grate-cap, when combined with the interior feeding cylinder.

153. DEVICE FOR HEATING FEED-WATER OF STEAM BOILERS; Samuel Lamon and W. S. Gaskill, Vanwert, Ohio.

Claim—The cylinder, or other suitable vessel, provided with the induction and eduction exhaust steam pipes, and the spiral or helical feed-water passages.

154. STEAM GENERATORS; A. B. Latta, Cincinnati, Ohio.

Claim—The method of regulating the circulation of water through the division coils by means of a dividing piece, constructed as set forth.

155. SELF-PRIMING GUN; Richard S. Lawrence, Hartford, Connecticut.

Claim—1st, The "shut-off," constructed as specified. 2d, Constructing the driver with its rear portion of about double the thickness of the pellets, and with the wedge-like bevel and the groove, as described. 3d, The combination of the downwardly extended tooth of the cover spring, and the notches in the shut-off, and in the lock-plate, as set forth.

156. ALARM LOCK; Henry Lockwood, City of New York.

Claim—1st, The bar, provided with the buttons, connected with the hammer-rod, and arranged with the latch and bolt, provided with projections, as set forth. 2d, The movable or adjustable plate or disk, arranged with the key-holes, and provided with projections to act on the button of the bar. 3d, The combination of the plates or disk and bar, when arranged with the latch and bolt, as described.

[The latch and bolt of the lock are connected with the hammers of a bell, so that an alarm will be sounded if either latch or bolt are operated, and there is another device which rings the bell when the key is applied to the lock.]

157. RAILROAD CAR SEAT AND COUCH; Wm. R. Jackson, Baltimore, Maryland.

Claim—The method of constructing the ordinary reversible seats of railroad cars, so that the backs can be brought down into line with the bottoms; but this I only claim, when the backs, when so brought down, occupy the positions previously occupied by the bottoms, and the bottoms are used to fill the intermediate spaces between them.

158. HARVESTERS; Gilderoy Lord, Watertown, New York.

Claim—1st, The rake-head, constructed in combination with the endless belt and tripping foot or hand lever. 2d, The combination of the ledge with the spring catch of the rake-head, arranged as set forth.

159. STEAM BOILERS; Edward Lynch, Washington City, D. C.

Claim—Circulating the water and aiding the generating of steam in the main boilers of ocean steamers, by passing the steam from the steam space of an auxiliary boiler into the water of the water space, below the ash-pit of the main boilers.

160. STEAM ENGINES; Edward Lynch, Washington City, D. C.

Claim—1st, The arrangement of the several parts of the engine in their relation to each other and to the propeller shaft, as set forth. 2d, Constructing the connecting rod of one of the cranks or cross-heads, in the manner described, so as to allow of its surrounding the propeller shaft.

161. FOLDING LIFE-BOAT; Henry Martin, Louisville, Kentucky.

Claim—The arrangement of the ribs, one-half of which folds towards one, and the other half towards the other side, in combination with the hinged bottom-boards, which, by means of slots, secure the ribs in an upright position, and are provided with seats hinged to the bottom-boards by means of rods, and connected by the dovetailed projections.

162. CARPET-BAGS; Jonathan M. Mathews, City of New York.

Claim—The combination of the two frames with the catches, as specified.

163. METALLIC LATH; Joseph W. Mauterstock, City of New York.

Claim—A metallic lathing composed of plates provided with slits, ridges, and furrows, as described.

164. SCREW PROPELLER; James Montgomery, Baltimore, Maryland.

Claim—A screw propeller composed of a plurality of blades attached to their shaft in one frame, or nearly so, when surrounded by a containing cylinder firmly attached to the peripheries of the said blades.

165. MACHINE FOR CORRUGATING METAL PLATES; Richard Montgomery, City of New York.

Claim—1st, Feeding the sheets or plates of metal at the proper time by a feeding device, as described. 2d, The feeding device, in combination with the adjusting pins on the first set of corrugating rolls. 3d, The combination of two sets of corrugating side guides, constructed as described. 4th, The corrugated sweeping and forming roll, constructed as described.

166. ATTACHING IRON ROOFING; T. W. H. Mosely, Cincinnati, Ohio.

Claim—1st, Securing the metallic roofing to the ribs or purlins, so that it may slide or move freely upon and in the direction of the length of the purlins. 2d, Securing the purlins to the rafters of the building, so that they may have freedom of motion in the direction of their length. 3d, The combination of the chairs, double flanched rail, anchors, and metallic roofing, as set forth.

167. REED MUSICAL INSTRUMENTS; E. P. Needham, City of New York.

Claim—1st, Applying and arranging two or more actions, one above another, above the rear portion of the key-board of a harmonium, or other reed instrument, in such a manner that one or more of such actions may be removed at any time, and any one be exposed for repair or other purpose. 2d, In combination with the so arranged actions, the passages, e e, and upright passage, f, arranged to combine the said actions with the bellows. 3d, Combining the several valves, or two or more of them, with the key, by a system of push-pins, or other equivalent direct connexion from one valve to another. 4th, The sound-board, applied to constitute the back of the wind passage.

168. SPARK ARRESTERS; J. F. Page, Philadelphia, Pennsylvania.

Claim—The intermediate casing, with its openings and deflecting plates, when arranged in respect to the chimney, the deflector, and outer casing, as set forth.

169. COFFEE POTS; J. B. Parish, Cleveland, Ohio.

Claim—The fluid valve cover, as arranged with the cup and the helical condensing tube, in the manner set forth.

170. WARDROBE BED; F. C. Payne and A. Reid, City of New York.

Claim—The combined arrangement with a secretary or wardrobe of a bed in the back thereof, in the manner described. Also, the arrangement of the brackets and board, for the twofold purpose of folding compactly to hold the clothes in place, the folding legs, the pulleys, the cord, and weight, as described.

171. WATER COOLER; A. H. Phelps, Trenton, Michigan.

Claim—The arrangement or combination of the tank, the refrigerator, and non-conducting chamber or casing. Also, in combination with preceding, the air chamber surrounding the faucet.

172. TREEING STICKS; L. L. Pollard, Worcester, Massachusetts.

Claim—The described treeing stick, when constructed in the manner set forth.

173. CLOTHES FRAME; Robert Ramsay, New Wilmington, Pennsylvania.

Claim—The combination and arrangement of the standard and the arms, with the bolts, washers, and springs.

174. DIRT SCRAPERS; A. J. Robison, Gypsum, New York.

Claim—The combination of the cam plate with the spring bar for consecutively releasing and retaining the scraper in position, as shown.

175. MODE OF APPLYING POWER FOR EXTRACTING STUMPS AND RAISING HEAVY WEIGHTS; Henry Rieman, Jr., Rogersville, Indiana.

Claim—1st, The combination with the worm shaft and spur-wheel, the arrangement and application of the movable pillow block and wedge to hold the said spur-wheel firmly in position, or admit of its being readily thrown out of gear. 2d, The adjustable supports, adapted, in the manner set forth, to sustain the machine on wheels, to convey it from place to place, and permitting its deposit on the ground while in operation.

176. MOLE PLOUGH; D. F. Robbins and Simeon Morrison, DeWitt, Illinois.

Claim—Making the beam of a mole plough in two parts, united by a horizontal joint to give it lateral adjustment. Also, connecting the drag (which supports, and upon which the point of the beam is made adjustable, vertically,) to the rear portion of the beam by a hinged joint or connexion, so that the raising or lowering of the point of the plough beam shall not affect the drag.

177. WATER WHEELS; J. S. Rowell, DeW. C. Teller, and M. Lowth, Beaver Dam, Wisconsin.

Claim—1st, The combination of a series of curved guides with the buckets of a water wheel, in the manner specified. 2d, Having the guides curved and fitted to a hub of a wheel, and arranged on a rising and falling governor or spring and regulated capping plate, so as to overhang the buckets and extend down, more or less, over the discharge orifices of the same.

178. OSCILLATING ENGINE; Mark Runkel, City of New York.

Claim—The segment with the projections, in combination with the shell and the abutment, or its equivalent, arranged as specified.

[The steam in this engine is admitted alternately to each side of an oscillating piston, which works in a shell similar to a rotary engine, the change of the direction of the steam being effected by a slide valve. The oscillatory motion of the piston being converted into rotary by mechanical means.]

179. HARVESTERS; Hiram H. Scoville, Syracuse, New York.

Claim—The arrangement of the propelling crank and stationary cam, with respect to the rake bar and universal joint. Also, suspending a swinging apron from the frame work over the platform and in front of the rake.

180. MACHINE FOR SPLITTING SHOE-PEGS FROM THE BLOCK; Winthrop D. Shaw, Tamworth, New Hampshire.

Claim—The feed roller in connexion with the two reciprocating or vibrating knives, the latter being so

operated that one will move slightly in advance of the other, so that the cuts will be given the block successively, and still admit of the proper feeding of the block to the knives—the feed roller being operated by the pawl, rendered adjustable by the attachment of the bent lever to the adjustable bar.

181. SKATES; D. H. Shirley, Boston, Massachusetts.

Claim—A sliding heel-piece or clamp, susceptible of being moved forward and back, and fastened at any desired point, in such a manner that the toe of the boot or shoe, being held by a suitable toe-piece or longitudinal binding force, can be brought to bear upon or relieved from the foot.

182. METALLIC COFFINS; Isaac C. Shuler, Amsterdam, New York.

Claim—1st, The arrangement of fastening the flanch or lower ends of the walls of a sheet metal coffin in a tray or pan, which forms the bottom, and which exceeds the circumference of the walls, by a narrow chamber which may be filled with molten metal for stiffening the base; also, the strengthening bars for stiffening the bottom of the tray. 2d, The arrangement of scrolling or doubling over the flush lower edges of the walls of a sheet metal coffin, soldering consecutively each fold of the sheet metal, thus making a solid rim or flanch of any required thickness, for the purpose of strengthening the base. 3d, The arrangement of placing on the outside of the walls, even with the upper edge, and extending downward any required distance, according to the size of the coffin, a sheet metal rim which may be filled with the molten metal, for the purpose of strengthening and keeping in shape the upper edges of the walls of a sheet metal coffin. 4th, I disclaim an entire frame for covering the joint of the air-tight lid of a sheet metal coffin, with the coffin walls; I also disclaim any bisected sliding cover, these being claimed elsewhere—but I claim the hinged lids as applied to the joint in different sections, for the purpose of allowing a greater number of ornamental breaks in the coffin walls. 5th, The frame for the support of the coffin handles.

183. FASTENING FOR SHIRT-STUDS; Henry Simon, Providence, Rhode Island.

Claim—Shirt-studs, arranged to operate in the manner specified.

184. HARVESTERS; John Smalley, Bound Brook, New Jersey.

Claim—1st, The combination of the seats, one of which is movable, with the seat frame, elliptical springs, and main frame of the machine. 2d, Constructing the outer piece in the peculiar manner described, viz: with two or more sockets, in combination with the caster-supporting hub and extension piece. 3d, The neck, in combination with collars, groove, standard, and lever, arranged for the purpose of throwing the gearing in and out of action. 4th, Supporting the reel arms by means of the peculiarly constructed hub.

185. COCKS FOR WATER BASINS; Horace W. Smith, Hartford, Connecticut.

Claim—The employment of the spring and the grooved and bevel face cam, when acting in combination.

186. EPAULETTES; James S. Smith, City of New York.

Claim—The arrangement and combination of the adjuster, fringe, and shell, as described.

187. GRATES; Philip Smith, Fall River, Massachusetts.

Claim—Hanging the front plate on pivots arranged so far below the top that, when the bottom is swung out, it will carry in its top and operate the inner upper plate, L. Also, arranging the plate, L, to vibrate. Also, the plates, H and H′, constructed as described. Also, making the plate, L, in separate pieces, fitted together in the manner described.

188. STOVES; Philo P. Stewart, Troy, New York.

Claim—The method of preventing the heat from striking through to the rising flue leading to the chimney, by separating it from the back oven plate, and from the two descending flues, by non-conducting partitions, or the equivalent thereof. Also, in combination with the flue above the oven, and with the rising flue leading to the chimney, the employment of a double-damper filled in with cement, or other equivalent non-conducting material, to prevent the heat from striking through from the top flue to the rising flue. Also, separating the direct flue under the oven from the return flue below by means of a plate lined with cement, or rendered non-conducting by equivalent means, to prevent the heat from striking through to the return flue, and thereby impart greater heat to the bottom of the oven.

189. TOOLS FOR FORMING LUGS IN THE MOUTHS OF BOTTLES AND JARS; Amasa Stone, Philadelphia, Penna.

Claim—Making one part of the spindle, which forms the orifice of the jug or bottle, to turn freely, while the other part remains stationary in the nose of the bottle. Also, making one, two, or more scores in that part of the spindle that turns freely, in combination with the corresponding score or scores in that part of the spindle which is stationary, and which aid in forming the orifice in the jug or bottle nose.

190. STOVES; David Stuart, Philadelphia, Pennsylvania.

Claim—The distributing chamber or discharge pipe, r, formed with a central projection, and supplied with heated air from the grate front through pipes, h. Also, the discharge pipe, z, located under the oven, and supplied from the grate front by pipes, k. Also, dividing the grate front horizontally into two series of heating chambers.

191. COVER LIFTERS IN COOKING STOVES; Philo P. Stewart, Troy, New York.

Claim—The lifter, made up of malleable cast iron and wood.

192. CONSTRUCTION OF NAVIGABLE VESSELS; R. H. Tucker, Jr., City of New York; patented in England, December 10, 1857.

Claim—The construction of navigable vessels in the form of isosceles triangles, with vertical sides and flat bottom, the base for that side of the triangular figure which terminates in the two equal angles, constitute the stern, in combination with the air chamber.

193. ROTARY HARROWS; S. M. Wade, Andover, Ohio.

Claim—The bar, K, provided with the arm, M, clutch, and pins, in combination with the angular draw bars and double harrows. Also, the rod, arms, Q, and rollers, in combination with the angular draw bars and double harrows.

194. WATER WHEELS; Paul Wagner, Buffalo, New York.

Claim—The combination of the buckets, D, arranged on the cylinder, E, and the stationary inclined planes or buckets, G, arranged with reference to the cylinder, H, and buckets, D, the whole being enclosed by the case, A.

195. VALVE GEAR FOR STEAM ENGINES; Elijah Ware, South Boston, Massachusetts.

Claim—Combining the eccentric rod with the valve rock shaft, by means of the lever, with its two arc-formed slots and the movable pins. Also, the combination with the double-slotted lever and its movable pins of the levers, Q V, rods, m U, levers, M N and T, secondary lever, O, pinion, u, toothed arc, S, and rods, L F.

196. SEEDING MACHINES; Moses D. Wells, Morgantown, Virginia.

Claim—The notches of the bar with the series of pins therein, in combination with the guides and upward projecting rims of the discharge openings.

197. QUILTING FRAME; Joseph Wetherill, Manchester, Connecticut.

Claim—The employment of the rolls, C D E, in combination with the arms, pawls, and notches, so that the upper roll, E, may be lifted when desired.

198. HOOP-FASTENING FOR COTTON BALES; George J. Widrig, Memphis, Tennessee.

Claim—The combination of the sides having slots or grooves with the bar, for the purpose of fastening cotton bales, or other similar substances, by bringing the last end over the bar.

199. CONSTRUCTING ELECTRO-PLATED ROLLERS; John W. Wilcox, West Roxbury, Massachusetts.

Claim—Covering the shaft, base, or support with a fillet or ribbon of metal, soldered or otherwise secured thereto, and depositing the copper on said surface by electro-plating.

200. BRICK MACHINES; Russell Wildman, Danbury, Connecticut.

Claim—1st, The vibrating arm, when constructed, combined, and operated as described. 2d, The vibrating feed, when constructed, arranged, and operated in combination with the mould.

201. GATES FOR CANAL LOCKS; C. W. Williams, Port Jervis, New York.

Claim—1st, The rods and rack applied to the gates. 2d, Having the journals of the gates fitted in oblong slots of the pulleys, which are placed in suitable bearings or boxes, and arranged to admit of the sagging of the gates, and the close fitting of the same when closed. 3d, Securing the bearings or boxes to the lock, by means of the rods, the boxes being attached to slides, and arranged so that the boxes may be adjusted as occasion may require. 4th, Operating the wickets by means of the gearing, whereby either wicket may be operated from one and the same crank shaft.

202. PLOUGHS; Wm. H. Wilson, Summerfield, Ohio.

Claim—The arrangement of the sub-soil shovel, the common shovel, coulter, and brace, constructed as described.

203. ADDING MACHINE; C. Winter, Piqua, Ohio.

Claim—1st, The arrangement of the lever, spring, shaft, wheels, and stops, in the manner set forth. 2d, The arrangement of the ratchet wheel, bevel wheels, pawls, cord, and pulley, in the manner described.

204. MODE OF APPLYING AND CONSTRUCTING HORSE POWER MACHINES; Wm. Zeller, Lebanon Co., Penna.

Claim—The construction by which it is made to drive a reaping machine or stationary power, as described.

205. HANGING BELLS; Henry Belfield, Assignor to self and Justice Cox, Philadelphia, Pennsylvania.

Claim—1st, The lever, G, its spring dog, and spring, f, in combination with the bell-crank lever, F, its hammer and spring, n, arranged in respect to each other and to the bell, as set forth. 2d, The bracket, with its four legs and projection for holding the bell, the said bracket being arranged in respect to, and in combination with, the levers, G and F, and their respective springs, in the manner specified.

206. REVOLVING PLUGS FOR MANUFACTURING BOTTLES AND JARS; John F. Bodine, Assignor to self, Wm. H., and Joel A. Bodine, Williamstown, New Jersey.

Claim—The large ring bearings, formed on and near the circumference of the turning plate, and fitting in ring grooves formed in the plug and capping plate.

207. MACHINES FOR CLEANING GRAIN; Harrison Fitts, Somerset, Assignor to self and Nelson Turrel, Addison, Michigan.

Claim—The combination of the adjustable piece with the concave and rubber, as set forth.

208. OBTAINING FIBRES FROM WASTE FELTED FABRICS; J. F. Greene, Brooklyn, New York, Assignor to S. B. Tobey, Providence, Rhode Island.

Claim—Subjecting the felts to be disintegrated to the successive and combined action of steam and picking, the steam having the effect either to so unfelt or loosen the hold which the fibres have on each other, in felted fabrics, that they can be drawn apart of sufficient length, to be advantageously employed in the manufacture of other felts or other fabrics.

209. MACHINERY FOR DISINTEGRATING WASTE FELT FABRICS; J. F. Greene, Brooklyn, New York, Assignor to S. B. Tobey, Providence, Rhode Island.

Claim—The combination of the steaming apparatus and the picker for steaming the felt, as it is passed to the picker to be disintegrated.

210. MACHINES FOR CUTTING CORN STALKS, &c., ON GROUND PREPARATORY TO PLOUGHING; Hezekiah Johnston, Assignor to self and Richard Withers, Collinsville, Illinois.

Claim—Arranging and combining the curved frame with the knives and the guides, in the manner described.

211. MACHINE FOR CUTTING FILES; C. Miller and T. W. Decker, Assignors to T. W. Decker, City of New York.

Claim—1st, Arranging the gauge rest to oscillate on a fulcrum located in relation to the cutting chisel, so that by moving the arm of said rest laterally, by means of the screw, the bed and blank may be adjusted to correspond with the cutting edge of the chisel. 2d, Hinging the frame which carries the chisel and its appurtenances to the frame by a joint at f, so that the rest may readily follow the curve of the file blank, and, with the chisel, be thrown back, when desired.

212. MACHINES FOR WRINGING CLOTHES; T. H. Peavey, Montville, Assignor to self and C. G. C. Collins, Portland, Maine.

Claim—The arrangement of the rollers, C and D, with the rollers, A and B, when constructed in the manner described.

213. THRESHING MACHINES; John J. Sigler, Assignor to self and W. M. Griffith & Co., Martin's Ferry, Ohio.

Claim—1st, The series of rollers provided with fingers or projections, in combination with the slab device, b b' b'', the fingers working in the spaces between the slats, and being used for the purpose of carrying the straw from the threshing cylinder to the place of discharge, and at the same time so tossing it as to secure an effectual separation of the grain therefrom, the slab device being employed for the purpose of supporting the body of the straw between the impulses of the fingers, and also for the purpose of preventing the straw from

winding on the rollers. 2d. The application of the oscillatory motion to the fingered shaft, by means of which I secure an agitation inwardly towards the fan, in addition to the throw towards the place of discharge, for the purpose of more effectually freeing the apertures near the tail of the riddle from obstruction, the required motion being obtained by means of the pinion, rack segment, and arm.

214. METHOD OF ARRANGING GALVANIC-ELECTRO HELICES FOR MAGNETIZING THE DRIVING-WHEELS OF LOCOMOTIVES; Orrin D. Vosmus, Boston, Assignor to self and Edward W. Serrell, Greenfield, Massachusetts.

Claim—A curved helix applied to the wheels of a locomotive engine, in substantially the manner specified, whereby the point of greatest magnetic effect is the point of contact between the wheels and track. And, in combination with the helix aforesaid, I claim adjusting the helix, in the manner and for the purposes specified.

215. PUMPS; Benjamin Douglass, for himself and as Administrator of the estate of Wm. Douglass, deceased, Middletown, Connecticut.

Claim—The combination of the lugs within the flanch, and the conical set nut for fastening the lower end of the pump cylinder.

MECHANICS, PHYSICS, AND CHEMISTRY.

*On the Co-efficients of Elasticity and Rupture in Wrought Iron, in relation to the volume of the metallic mass, its metallurgic treatment, and the axial direction of its constituent crystals.** By R. MALLET, M. Inst. C. E.

[Read before the Institution of Civil Engineers, March 1, 1859.]

It was assumed that amidst the numerous theoretical treatises upon, and practical investigations into, the strength and other properties of iron, the two questions which formed the prominent features of the author's present experimental inquiry had remained comparativley untouched. The conditions of manufacture and the resultant qualities had been hitherto too lightly passed over.

Iron was formerly entirely worked under tilt hammers; the process of rolling was then introduced, and now, in consequence of modern engineering requirements, masses of iron of considerable magnitude were produced by faggoting together, under heavy forge hammers, from large numbers either of bars or slabs grouped together. The masses were not however found to possess ultimate strength in proportion to the number of bars of which they were composed; in fact, it appeared that the strength of the mass became less in some proportion as the bulk became greater. This was admitted as a fact, but no one had hitherto attempted to show experimentally—what function of the magnitude was the strength of a given kind of iron manufactured in a given manner; or how the same forged mass, when very large, differed in strength in different directions with reference to its form; or how the mechanical part of the process of manufacture of the same iron affected its actual strength, either as a rolled bar or forged mass.

Addressing himself to this investigation the author dealt generally with three points of the inquiry, viz.—

1°. What difference did the same large bars of unwrought iron afford to forces of tension and of compression when prepared by rolling, or by hammering under a steam hammer?

2°. How much weaker per unit of section, was the iron of very massive hammer forgings than the original iron bars of which the mass was composed?

3°. What was the average or safe measure of strength per unit of

* From the Lond. Civ. Eng. and Arch. Jour., April, 1859.

section, of the iron composing such very massive forgings as compared with the acknowledged mean strength of good British bar iron?

In the investigation of these questions other subordinate but very important points arose: such as the determination of the relative longitudinal and circumferential strength of equal sections of the iron in massive cylindrical forgings.

The proper measure of the strength of iron, or any imperfectly elastic material, was the "work done," whether by extension, compression, rupture or crushing, due to any force applied to it. The co-efficients *Te* and *Tr* were designed by Poncelet to express this work done by an extending or compressing force upon any elastic prismatic body at the point where its elasticity became permanently impaired and its form distorted, and at the further point where rupture occurred. The method of arriving at these co-efficients was then given, and it was shown that, though they were not sufficiently attended to in practice, yet that they were the true measures of the safe and ultimate resistance of materials when applied constructively in machines or otherwise.

The crystalline structure of iron was then considered, and quoting from the author's communication to the Royal Irish Academy (*Trans.* vol. 23, p. 1, 1855), it was shown to be a law that "Iron, whether in the state of cast or of wrought iron, has the principal axes of its integrant crystals arranged in the lines of least pressure within the mass."

If consolidation from fusion took place undisturbed, as in cast iron, the principal axes would be arranged in the directions in which the heatwave had passed outwards from the body in cooling; which would be perpendicular to its surface contour,—those being the direction of least pressure of the internal constraining forces, produced by contraction in cooling, which were necessarily parallel to the planes of external contour.

The effects of rolling and of hammering masses of wrought iron of different contents were then treated of, and it was shown that what was termed "fibre" was the longitudinal extension of the principal axes of the crystals. The original development of these crystals under the constraining forces due to change of temperature, &c., was "cæteris paribus" proportioned to the time given for such development. Thus, in very large forgings the crystals were generally extensively developed, in consequence of the length of time which the mass had been under the operations of heating and forging.

It had long been admitted that large forgings became weaker in proportion as their bulk was increased, but as no definite ratio was recognised it became of importance to fix the conditions of strength in wrought iron under various circumstances. The author was enabled to undertake this investigation, under the authority of the Minister of War, and with the concurrence of the Royal Society, when making the forgings for the two 36-inch wrought iron mortars constructed on his design for the Government; he then selected specimens of iron upon which the experiments of tension and compression were tried.

The methods were then explained by which the specimens of iron were obtained from large masses, and the apparatus was described by

which the observations were made, when the specimens were undergoing the operations of extension and compression. In cutting and boring into the massive cylindrical forgings to obtain the pieces of iron from the various parts, it was invariably found that there existed internally large transverse rents, with jagged and crystalline irregular surfaces, the opposite faces of which were counterparts, and presented distinct evidences of having been torn asunder by contraction from the centre towards the circumference as the mass cooled. The *rationale* of the phenomenon appeared to be, that this action was simply due to the contraction of the external shell before the temperature of the centre had been perceptibly lowered; this in its turn was cooled, and in contracting produced these visible rents or fissures, and no doubt caused other minor dislocations, which detracted from the general strength of the mass.

This was evidently the cause of the difficulty of obtaining very large forgings of a cylindrical form quite sound; as if the diameter was sufficiently great all such cylindrical forgings so built in construction, and so treated by heating, hammering, and cooling in manipulation, must become unsound internally by the opening within the mass of one or more of these rents in the direction of the axis during the process of cooling. In solid cylinders, or conic frustra, it must occur whenever the dimensions were such that the total amount of contraction of the metal in any one diameter from its highest temperature down to that of the atmosphere, as fixed by the circumference of rigidity due to the outer cold shell, exceeded the limit of extension of the iron at rupture due to the length of the diameter of the interior core, which cooled last. This was the theoretic limit of size of forging, beyond which internal rents must occur. The practical illustration was, that almost all cylindrical shafts of wrought iron exceeding 12 inches in diameter were found to have one or more of these rents in them, thus having their strength impaired. This reduction of strength was altogether distinct from any deterioration of quality of the metal, arising from its being alternately heated and cooled and hammered.

The remedy for this play of molecular forces was to construct and work the large forgings hollow. This course had been pursued with success at the Mersey Iron works, Liverpool. When a cylinder had a large concentric cylindrical hole along its axis it cooled at the same time, though not equally, on both the internal and external surfaces, and thus the extremes of internal strains were avoided, and the hollow centre yielded more readily to the forcible compressive grasp of the exterior.

A minute description was then given of all the irons which had been experimented upon, specimens of each being exhibited at the meeting. They were divided into classes according to their several characteristics and modes of working, and into the most analogous class was imported Clay's puddled steel, a comparatively new material, which had been brought into this investigation for the purpose of comparison, and the results were such as promised to be of great practical importance. The general results were the separation of several classes into

two grand divsions: 1°. The crystalline, or sub-crystalline in fracture, which were always the result of manufacture by the hammer. 2°. The fibrous or crystallo-fibrous, which were always produced by the rolling process, but which might be produced by careful and continuous elongation under the hammer.

The very weakest wrought iron of all those experimented upon was found to be that cut transversely from the end of a very heavy cylindrical forging which had been exposed to heat and percussion for nearly six weeks. Exposed to tension its elastic resistance was only $3\frac{1}{4}$ tons per square inch, which was less than the average of cast iron; thus, as regarded pressure, it was the very weakest iron produced by any method of manufacture; whilst the faggot bars of which the mass was built and welded up, bore a tension of upwards of 12 tons per square inch before losing their elasticity, and of nearly 23 tons at rupture, and a pressure of nearly $21\frac{1}{2}$ tons before losing elasticity, and of nearly $27\frac{3}{4}$ tons at the point of total distension or crushing: thus proving the fact that the extreme weakness of wrought iron in heavy forging was not due to any metallurgical alteration in the constitution of the metal, but to changes in its state of aggregation, induced by a process of forging, by the long-continued and unequal heating, and by the hammering.

Hence was deduced the conclusion, that practically the iron of very heavy shafts, forged guns, huge cranks, and other similar masses, might be expected to become permanently set and crippled at a trifle above 7 tons per square inch, and to give way by fracture at about 15 tons per square inch by tension, and to completely lose form at pressures of from 15 to 18 tons per square inch. Therefore it followed, that allowing a deduction of one-half, as sanctioned by practice, from the elastic limits of tension and of pressure for the margin of safety, the iron of such forged masses should not be trusted for impulsive strains exceeding about $1\frac{3}{4}$ ton per square inch of tension, and about $4\frac{1}{2}$ tons per square inch of pressure, or for passive tensile-strains of $3\frac{1}{2}$ tons per square inch, or for passive pressure beyond 9 tons per square inch.

Further experiments demonstrated that in heavy rectangular forged slabs of upwards of 12 inches in thickness, in the plane of the slab, the resistance to all the forces was much higher, and hence large cranks which were usually cut out of such rectangular forgings were stronger than the shafts to which they were attached, in the ratio of 8 to 6. The physical cause of the difference in strength between large cylindrical and rectangular forgings, although made from the same original material, was to be found in the difference of the molecular arrangement. The integral crystals of the cylindrical masses were strained, distorted, and partially separated by the effects of hammering in various directions, and by the peculiar constraining forces due to the contraction in cooling; whereas, none of these forces acted to the same extent upon rectangular masses, which were only hammered in three directions, and the constraining forces of cooling were all parallel to the faces of the parallelopiped, or in three directions only.

A special peculiarity noticed in heavy forgings was the sudden and extreme inequalities of texture and of strength found in different and even in closely adjacent portions of the same mass, producing greater uncertainty of result in practice.

Another peculiar feature was that the rates of extension or of compression did not move uniformly, but by fits and starts. This phenomenon obviously arose from the *per saltum* disintegration of planes of crystallization, and their more or less complete separation in a crystallized but yet ductile body. This had never been observed in fibrous irons, or in those in which the finely elongated crystals were all rolled parallel and in the line of the length of the bar or the sheet.

If the original or integrant faggot bars, from which a heavy forging was built and welded up, had a tensile elastic strength of 12 tons per square inch, the forged mass itself would have a mean tensile elastic strength of only 7 tons per square inch; and correspondingly if the faggot bar had a compressive elastic resistance of 2½ tons, the forged mass itself would range under 18 tons per square inch.

Thus, within the limits of practice, the work of passive resistance sustainable by heavy forgings was about one-half that of the faggot iron from which they were manufactured; but at the ultimate point of rupture they gave a better result. Heavy forgings were also more trustworthy when exposed to tensile strains in direction of their length or to transverse strains, as in girders, which ultimately were resolved into longitudinal strains, than when subjected to twisting strains, as in shafts, or to direct pull across the direction of length.

These and other considerations induced attention to the apparently superior power of puddled steel to support the forces by which the ordinary forged masses of wrought iron were fractured, especially as by the employment of smaller and lighter masses greater strength in shafts, &c., could be secured. One special peculiarity appeared to be, that in the heaviest pieces of this material the internal structure was as fine and close in the grain as it was in the smallest bar. The elastic limit was above that of the best wrought iron, and the elasticity was so much more perfect, that it might be trusted almost up to the elastic limit of about 15 tons per square inch, and in forged masses it possessed this strength nearly equally in every direction. The range of extension at the elastic limit was rather greater than that of fibrous hammered bar iron of excellent quality. Beyond the elastic limit, with equal increments of strain, its extension did not rapidly diverge and increase, as in wrought iron; it slowly increased up to about 20 tons per square inch, and gradually and evenly enlarged up to the breaking point, which was not reached within 42 tons per square inch, and was often found to reach 48 tons per square inch.

This puddled steel was not like cast steel, a harsh, rigid, and glassy material, which possessed indeed enormous cohesion, but yet was so rigid and unaccommodating to forces variable in direction and impulsive in character as to deprive it of trustworthiness in practice. On the contrary, puddled steel appeared to combine the great strength of cast steel with ductility and perfect elasticity of the best wrought iron.

Its resistance to pressure was very remarkable, being more than double that of harsh crystalline wrought iron, and more than three times that of the best fibrous wrought iron in bars or plates. Thus it may be safely used under a passive strain or load of 20 tons per square inch, after allowing a margin of one-half for security.

Puddled steel would thus evidently become an important practical adjunct in the construction of machinery, in building vessels of light draft of water, and for artillery of the largest calibre. It possessed also the peculiarity of resisting corrosion much better than wrought iron plates, and thus had an additional value for ship-building.

An investigation was then entered into of the causes of the manifestly greater strength of the integrant slabs than of the large forgings built up from them; but it was shown that this quality did not extend to the boiler plates which acquired a certain amount of rigidity. This was also possessed by the puddled steel, and it was anticipated that it would ultimately be extensively employed for the boilers, and even the fire-boxes of the locomotive boiler.

From this investigation nothing of a certain character could be concluded as to any fixed relation between the strength and the specific gravity of the several sorts of iron experimented upon. The weakest irons—those from the heavy forgings—having generally the highest specific gravities, though always lower than their integrant faggot bars. Thus it appeared that specific gravity was a characteristic to which too great importance had hitherto been attached in relation to strength both in cast and in wrought iron. It was modified, increased, or diminished by the mechanical operations of manufacture to an extent far beyond anything that chemical difference of constitution produced, and in reality it afforded no criterion of strength, although in fibrous irons it did afford an index of their degree of extensibility for equal size.

The modulus of elasticity deducible from these experiments, from the mean results of the great forgings, was 12,559,680 lbs., or 3,771,675 feet for iron forged in great cylindrical masses. The mean specific gravity being taken at 7·663, the weight of 1 foot long by 1 inch square of this iron was 3·33 lbs. The modulus for great forged rectangular masses or slabs was 18,079,200 lbs., or 5,478,545 feet; the specific gravity being 7·610, and the weight of a bar 1 foot long and 1 inch square 3·30 lbs. Both fell far below the modulus for good English bar iron of 7,550,000 feet as deduced by Tredgold, or even below 6,787,878 feet as deduced by Edwin Clark from Eaton Hodgkinson's experiments.

The author concluded his paper by recording the obligations he was under to Messrs. Horsfall and to Mr. Clay, of the Mersey Steel Works, Liverpool, and to the officers of the War Department and Royal Arsenal Woolwich, for the facilities afforded to him during his investigation.

*New Paper Materials.** By M. C. Cooke.

One result may fairly be attributed to the offer of a premium, by one of the daily papers, for a new and available paper-stuff, which should supply the deficiency of rags; and that result an important one. It has stimulated many an effort to supply that want not only at home but abroad; and we are now in a much better position to do without rags for our own paper manufacture than at any other period of our history. It may be true that the premium has never been paid, but it is equally true that we are nationally full the thousand pounds richer on account of that offer. Why it has not been paid, forms no part of this inquiry, neither to whom it should have been awarded. Let it suffice to point to some of its results. Out of the numerous efforts to furnish good paper with only a per centage of rags, one of the most successful with which I am acquainted is that of Dr. Collyer, which was patented in 1857. It consists in applying the residue of the beet-root left in the process of sugar-making and distillation to the manufacture of paper, papier mache, millboard, and other paper manufactures. One feature pointed out in the process of this manufacture is, that no sizing is necessary, on account of the nature of the material used. In consequence of the whole mass being permeated, instead of the surface alone being covered, it is, from its compactness, solidity, and elasticity, not liable to crack, and for the same reason will resist damp and moisture when in the form of paper. The patentee states, "The extraordinary tendency which the cellulose, starchy, and proteine substances have to enlarge when exposed to heat and moisture, renders them very valuable for giving strength to other material, especially to cotton, which is deficient in these properties. When thus mixed each fibre of the cotton becomes cylindrical and thick, and attains the strength of hemp and flax, and no longer loses its shape through pressure. A similar improvement is evident when it is combined with other materials. A proportion of 10 per cent. of the prepared residue with the other usual material, makes tougher and more flexible paper. Twenty-five per cent. renders packing paper sufficiently waterproof that it will require no other sizing. Fifty per cent. will produce paper nearly or quite as strong as parchment, and which in very thin sheets will preserve articles packed in it from dampness. Strong paper, cardboard, &c., can be made from 75 per cent. of prepared residue and 25 per cent. of cotton; also of 50 per cent. of prepared residue, 40 per cent. of raw residue, and 10 per cent. of saw-dust, hay, straw, &c. Fifty per cent. of prepared residue and 50 per cent. of fine cut straw will produce strong packing paper, as will also 50 per cent. of white saw-dust, 30 per cent. of prepared residue, and 20 per cent. of cotton rags. A good, strong, white paper for printing purposes has been made with 50 per cent. of beet-root residue and 50 per cent. of cotton, no sizing being required in the process, and the result has been entirely satisfactory, the paper so made being remarkable for its tenacity. It will, however, have

* From the Lond. Jour. of the Society of Arts, No 321.

been observed that something beside the beet-root residue is required to make good paper, and that the best substance for that addition is cotton or cotton rags, the use of which this patent does not supersede."

Another patent, or rather series of patented paper pulps, worthy of notice, are those of Mr. Plunkett, of Dublin,* in all of which the material, *per se*, is capable of furnishing serviceable paper. Patented also in 1857, the entire value and capabilities of the materials have not yet been fully ascertained. Mr. Plunkett's papers are made from four different plants, any one of which furnishes a good paper pulp, and may be obtained in almost unlimited quantities. These are the tree-mallow, red clover, hop bine, and yellow water-iris. To the first of these we may look, perhaps, for the most satisfactory results. The order to which the tree-mallow belongs is composed of eminently fibre-producing plants. Independent of the cottons, we have numerous species of *Hibiscus*, *Sida*, *Abutilon*, *Urena*, and *Thespesia*, yielding useful fibres which leads us to expect, perhaps to find in *Lavatera arborea* a good material for pulp.

"The tree-mallow grows wild on several parts of the south-west coast of Britain, as well as on the east coast of Scotland, on rocky cliffs, flowering in July, and often producing a long succession of bloom. In gardens the plant often remains some years without blossoming, but dies in the winter after it has flowered, being naturally biennial. Seeds scattered in the ground will, some of them, keep springing up every season for an undetermined number of years, but the young plants are impatient of the cold, except in maritime situations, and few of them survive even a single winter. The root is deep and much branched; stem, 6 to 10 feet high, upright, straight, round, simple, except in the upper part, where it forms a branched leafy head. It is clothed with clusters of small deflexed bristles. Leaves alternate on long stalks, pliable and downy, of seven shallow crenate lobes. Flower on simple axillary clustered stalks, very much like those of *Malva sylvestris*. Outer calyx deeply divided into three large lobes, but not as in Malva formed of three separate leaves. A slight or rather artificial distinction."†

On inquiry, I find that the *Lavatera* will, with the addition of saline manure, grow freely on the deepest bog land. My informant states that he has seen it in perfection on the west coast of Donegal, growing where there was very deep bog, at least thirty feet. A gentleman in Londonderry, who is owner of a large tract of slob land, intends cultivating the plant extensively next season, for which purpose he has about 250 acres at disposal. When this experiment shall have been made, we shall be in possession of facts as to the cost of culture and the produce per acre. The plant, if cultivated, would not only yield hemp enough for home use, but also give, from the hacklings, or tow, and the wood, a large supply of paper material. The quality of the hemp obtained from the bark would command for it a ready sale.

* Specimens of these substances were shown at the Society's last Annual Exhibition of Inventions. See Catalogue for 1858. No. 301.—Ed. J. S. A.

† English Botany, or Colored Figures of British Plants. London, 1803.

Cordage has been made from it experimentally, and so satisfied were the company entrusted with the manufacture of the specimens, that they have guaranteed the purchase of any quantity which may be grown on the Londonderry estate next season. The refuse leaves, wood, and tow, would furnish paper pulp.

The process of manufacture of paper from these substances is that ordinarily pursued. The wood has to be reduced to chips or shavings, and whether wood, leaves, or tow, boiled in caustic alkali and bleached in the ordinary manner. The paper thus made presents no external variation from that made of rags.

Specimens of the plant, wood, hemp, cordage, fine thread, and lace, made from this plant, together with paper made from the wood, I shall be happy to show to any one interested in the experiment.

Another substance used by Mr. Plunkett for paper pulp is the common red clover, *Trifolium pratense*, in order to obtain which, the clover is taken, either in its green state or when dried into hay, and first submitted to a rippling process, by means of which the leaves and blossoms or seeds are saved as fodder for cattle. The stalks are then submitted to the action of caustic alkali, bleached and pulped in the usual manner. Paper and cardboard produced from this pulp is also of a firm and excellent quality.

A third material is subjected by the same gentleman to a similar process with a like result. This substance is the hop bine, or twining stems of the *Humulus lupulus*, a material which, in many parts of the country, may be obtained in almost any quantity, and which has been hitherto regarded rather as a nuisance than as a stock to be converted into a valuable article of trade. Instead of being as heretofore, burnt up for manure, Mr. Plunkett has shown that it may be converted into a useful paper, the dried bine yielding from 70 to 75 per cent. of fibrous matter.

The fourth and last of Mr. Plunkett's papers is made from the yellow water-iris (*Iris pseudacorus*), which is not only a very common weed in Ireland, but is also common enough in the marshy parts of England. It yields when dry, about 60 per cent. of available fibre or half stuff, and, as far as one can judge from unsized specimens made by hand, will make a paper equal to that produced from either of the other sources.

Hence it will be seen, that the Irish patents, in each instance, offer a material, not to be used in conjunction with rags or other fibre, but independently, as substitutes for those substances. In each case the raw material is either common enough, or, as in the instance of the Lavatera, may be easily cultivated on waste lands in sufficient quantities to supply all our wants; and beyond this to furnish us with a fibre for cordage and textile manufactures of a new but valuable kind at home, instead of seeking supplies from Russia and India.*

Independently of "substitutes for paper material" at home, and

* The last patented paper material is that of Mr. Haughton, for converting the refuse of flax straw into pulp. The process consists of an application of an alkali, in a heat of nearly 400 deg. Three tons of flax refuse, at from 20s. to 50s. per ton, can, it appears, be converted into one ton of pulp. The rags for the same amount of pulp would weigh one ton and a third, and the lowest price of rags is £15 per ton.

of the premium before alluded to, the reports of the Paris Universal Exhibition contain an interesting account of a paper material now in course of manufacture by a company established at Florence from the common asphodel (*Asphodelus ramosus*). The roots are first made to undergo a process of distillation, during which alcohol is obtained, and the residuum, together with the other parts of the plant, is converted into card paper, cards and paper, including writing papers of various qualities. The gum which abounds in asphodel, is a highly advantageous ingredient; it gives gloss to cardboard, and prevents writing paper from becoming absorbent. The stoutest cartridge paper which is made from this plant is found to bend without breaking, and is not apt to tear. Corsica, Spain, Algeria, Portugal, all have hastened to follow the example of Tuscany, and to seek to derive advantage from asphodel, either as yielding alcohol or paper-stuff, or both. If even the enormous tracts which are covered with asphodel should in time be exhausted, the culture of the plant is by no means difficult. The manager of the Grand Duke's domain, at Alberese, offered, a few years ago, 40,000 francs for the extirpation of the asphodel, in a comparatively limited territory, and no person was found to undertake the next to impossible task. It is stated, moreover, that the asphodel produces alcohol and paper, at a much cheaper rate than any other material which has yet been tested, and there is good reason to hope that it may yet prove a providential benefit to many sterile and unproductive districts.

From North America, I have just received a series of specimens of what our brethren are doing on the other side of the Atlantic in paper stuffs. This series contains white pulps, made from white pine, yellow pine, white cedar, red cedar, hemlock, spruce, white oak, maple, gum, chestnut, ash, bass, sycamore, birch, catalpa, beech, willow, paper mulberry, mulberry bark, black walnut, elm, tulip poplar, hickory, straw, reed, maize, and sun-flower. The American straw papers seem to possess tenacity and quality superior to those of British manufacture. To what extent these wood papers are made and used in America, I have as yet received no information, the promised papers and particulars not having come to hand.

These remarks on new materials for paper, are essentially fragmentary; there are many other substitutes, and some not generally known to the public, which have been patented and experimented upon within the past two or three years; but to enter into any particulars concerning them, would extend this paper far beyond the limits I have assigned to it.

It would not be an uninteresting or impossible inquiry to ascertain the history and progress of this question of rag substitutes for paper during the past seven years—a subject to which I may return at some future opportunity.

Trinity School House, Lambeth.

*The First Galvano-Electric Telegraph.**

It was the Russian Baron Schilling who, at Munich, so long ago as 1816, had invited the Honorable Frederick James Lamb, then British Envoy and Minister Plenipotentiary to the Court of Bavaria, to accompany him to Dr. Samuel Soemmerring, in order that he might see his telegraph, the first ever made to act by a galvanic battery. Schilling having introduced the British Minister to Soemmerring on the 2nd of July of the year mentioned (1816), repeated the visit with him ten days later, the 12th of July, when the telegraph was made to operate before them. Besides the brother of Lady Palmerston and the Russian Baron Schilling, there were on that occasion present also, the Countess Banfy, Schilling's sister and her husband Count Banfy, from Vienna, then on a visit at Munich. Dr. Hamel proves that the date of Soemmerring's invention is nowhere accurately stated. His first telegraphic apparatus was made between the 9th July and 6th August, 1809. Baron Schilling, who was at that time attached to the Russian mission at Munich, saw it for the first time on the 13th August, 1810, and from that day he became an enthusiastic laborer in the field of electric telegraphy. In the autumn of 1812, he was enabled, by means of a subaqueous conductor, planned by him in April and May, at Munich, to explode powder mines across the river Neva near St. Petersburg. Subsequently he made the very first electro-magnetic telegraph, a copy of which, in 1836, found its way through Bonn and Heidelberg to London. In 1837 there was at St. Petersburg a submarine cable making for him, with which he intended to unite Cronstadt with the capital, through the Finnish Gulf. His death, which took place on the 7th August, prevented the execution of this early submarine telegraph enterprise.

On a Peculiar Case in which Baryta is not Precipitated by Sulphuric Acid.† By T. Scheerer.

The author observed, that in the salt of phosphorus employed in blowpipe experiments, which often contains sulphuric acid, the latter cannot be detected by the salts of baryta when the salt has been fused. From this he concluded that metaphosphoric acid prevents the precipitation of sulphuric acid in the form of sulphate of baryta, and further experiments have confirmed this view.

If a large quantity of dilute muriatic acid be added to a solution of metaphosphate of soda, and then solution of chloride of barium, dropped in and mixed by stirring in order that the precipitate of metaphosphate of baryta formed at first may dissolve again in a sufficient excess of muriatic acid and water, the addition of very dilute sulphuric acid to the perfectly clear solution produces no precipitate of sulphate of baryta. After standing for several hours and sometimes

* From the Lond. Jour. of the Society of Arts, No. 328.
† From the Lond. Chemical Gazette, No. 391.

even for days, the fluid begins to grow turbid; but if it be boiled, this operation causes the formation of more or less of a white precipitate.

Repeated experiments showed the author, that the production of these phenomena depends on the degree of dilution of the sulphuric acid, and also that neither the ordinary tribasic phosphoric acid, nor pyrophosphoric acid, has any influence upon the appearance or non-appearance of the sulphate of baryta.

For the Journal of the Franklin Institute.

Description of J. E. Wootten's Improved Water Gauge.

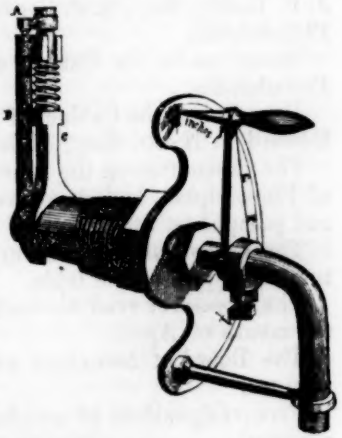
The instrument represented in perspective by the accompanying illustration, is designed for ascertaining the exact level of water in steam boilers.

Its nature consists in being provided with a right-angled tube of about half an inch diameter, with a bore of three-sixteenths of an inch. The arm, B, of this tube, when at rest, stands perpendicularly within the boiler, and should be of such length that when its position is reversed it is capable of reaching the lowest level of water which the boiler may contain with safety.

The other arm passes through a stuffing-box within which it should be free to have a semi-rotative movement upon its axis—and a lever is attached to its outer end for the purpose of imparting to it the necessary motion.

A thread cut upon the body of the instrument serves to make the necessary connexion with the boiler.

The aperture at the upper end of arm B, is covered by a conical valve, A, which is actuated by means of the lower end of valve rod, C, passing over a cam when the instrument is brought into operation. The lift given to the valve is rather less than an eighth of an inch, being quickly raised and held uniformly open during trial. A spiral spring is employed for the purpose of keeping the valve seated when not in use.



A dial is attached to the instrument, which, being graduated in inches, indicates by means of a pointer the height of water (above the lowest admissible level,) which is contained within the boiler at the time of trial.

When it may be desired to ascertain the water level, the handle should be moved in the direction of the figures; the valve, A, is at once lifted from its seat and a passage opened through the tube. When the end of arm B, in its descent has reached the surface of the water, its level is indicated by the position of the pointer in reference to the figures upon the dial face.

Upon restoring the handle to its original position, the valve rod reaches the depression of the cam and the valve is allowed to close.

The advantages of this instrument over the gauge cocks commonly in use, are, its adaptation to denote the *exact* height of water—its freedom from leakage and consequent cleanliness, as well as its non-liability to the choking and stoppage incident to the ordinary form of gauge cock.

The comparatively small space occupied by the instrument is also worthy of consideration. The funnel for receiving the discharged water need not exceed one-and-a-half inches diameter, and the entire arrangement will occupy considerably less room than is required by a set of gauge cocks, with their customary appendages.

FRANKLIN INSTITUTE.

Proceedings of the Stated Monthly Meeting, May 19, 1859.

John C. Cresson, President, in the chair.

John Agnew, Vice-President,
John F. Frazer, Treasurer,
Isaac B. Garrigues, Recording Sec., } Present.

The minutes of the last meeting were read and approved.

Donations to the Library were received from the Royal Institution, The Institute of Actuaries, and Edward Smith, M. D., London; the Austrian Engineers' Association, Vienna, Austria; Prof. A. Dallas Bache, Coast Survey, Washington, D. C.; the Water Commissioners of the City of Detroit, Michigan; the Mechanics' Institute, San Francisco, California; Edward Miller, Esq., C. E., St. Louis, Missouri; J. P. Lesley, Esq., A. J. Brasier, Esq., and Professor John F. Frazer, Philadelphia.

Donations to the Cabinet of Models from Prof. John C. Cresson, Philadelphia.

Donations to the Cabinet of Minerals and Geological specimens from Edward T. Hyatt, Esq., Philadelphia.

The Committee on the Library reported that Henry Seybert, Esq., of Philadelphia, had deposited in the Library, 180 volumes of books and pamphlets, for the use of the members.

The Periodicals received in exchange for the Journal of the Institute, were laid on the table.

The Treasurer read his statement of the receipts and payments for the month of April.

The Board of Managers and Standing Committees reported their minutes.

Five resignations of memberships in the Institute were read and accepted.

Candidates for membership in the Institute (6) were proposed, and the candidates (5) proposed at the last meeting were duly elected.

Mr. Wm. Golding exhibited an eccentric wheel and strap, in which the friction usual to such pieces of machinery is got rid of by means

of friction rollers attached to the strap and bearing upon the face of the wheel.

A model of a bridge for short spans, in use upon the Mine Hill and Schuylkill Haven Railroad, was upon the exhibition table for the inspection of the members. It is simple in design, and not expensive. The righting of the bridge is done by means of struts, which abut at the middle of the span, and have their lower ends resting upon plates inclined towards each other, and set against the abutments. These ends stand some distance apart, and are kept from sliding down the inclined plates by a bolt passing through both. By screwing up the nut of this bolt, the struts approach each other and move up the inclined plates, when the abutted ends rise, and with them the cross timber of the bridge. Also, a working model of a switch lever used upon the same road, in which the catch is moved by a supplementary lever operated by the act of grasping the main lever, in the mode adopted for the starting bar of marine and locomotive engines.

A. C. Jones explained his self-acting coupling for fire engine and other kinds of hose, steam, gas, or water pipes, which require to be frequently connected and disconnected.

It is self-fastening and self-tightening in principle. The hose coupling shown to the meeting consists of a brass male and female secured to the ends of the hose in the usual manner; the female is of a conical or flaring form to receive the end of the male, which has a pipe or ring of vulcanized rubber projecting three-eighths of an inch from its interior. This short pipe passes into the female, and the pressure of the water or steam against its inner surface forces it in contact with the surrounding metal, and makes the joint, and its tightness increases with the pressure; all other couplings are the reverse of this, for as the pressure increases the tendency to leak becomes greater.

The coupling may be connected or disconnected by night or day in a second of time without any tools being required, and when constructed, twisting, shaking, or throwing about will not open it; and the more pulling strain is put on it the firmer it becomes locked.

The locking or coupling is effected by a peculiar shaped clamp or pawl resting on a bed between jaws formed on the two sides of the female; this clamp has a shoulder at one end and a broad hook at the other; the shoulder rests against a bearing on the female, and the hooked end drops into an appropriate formed groove extending around the extension of the male.

All the pulling force is applied in a straight line, thus,
The clamp is kept in place by a pin passing through the sides or jaws, and a small slot in the substance of the clamp; in this narrow hole a small piece of rubber is placed; when the hooked end is raised the rubber is compressed against the pin, and when the pawl is released the elasticity of the rubber restores it to its flat bed.

To couple, the two parts are pressed against each other, the clamps open admitting the male, and the hooked ends drop into the groove, and are kept there when the hose or pipe is without pressure, by the elasticity of the rubber before mentioned; kicking and various other forcible means have been tried to open it, without succeeding. To un-

couple, only one clamp need be raised; this can be effected by the thumb and finger raising the end out of the groove, or a knife, nail, &c., may be used as a lever.

The advantages which the inventor claims over *all* other hose couplings are: that it is *shorter, lighter, more quickly coupled or uncoupled* by one man, in the *dark* or by daylight; a more *perfect swiveling;* will bear *more* "wear and tear;" sustain *more change of form* without preventing its use; less first cost, and no loose parts to get lost, and that no injury short of total destruction will prevent the use of the section of hose at a fire.

COMMITTEE ON SCIENCE AND THE ARTS.

Report on Mr. S. W. Hall's Thermograph.

The Committee on Science and the Arts constituted by the Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts, to whom was referred for examination "a Thermograph," invented by Mr. S. W. HALL, of Philadelphia, Pennsylvania,

REPORT:—That the apparatus of Mr. Hall is formed of a spiral glass tube, terminated outwardly in a branch which is prolonged with a smaller curvature; this tube is delicately balanced upon a horizontal axis. The spiral portion of the tube contains alcohol (or any other liquid or gas), while the prolonged branch contains a plug of mercury, which is in contact at its inner surface with the alcohol, while on its other side it has a partial vacuum formed in the outer end of the tube. Of course, as the alcohol expands or contracts, the mercury is moved farther from, or nearer to, the axis, and the change in the position of the centre of gravity of the system causes a rotation around the axis, and this motion is transferred by levers to a needle point, which is lifted or depressed, according as the alcohol is expanded or contracted. In front of the needle a band of paper is made to pass with an uniform motion, communicated to it by rollers which at the same time print upon it a series of horizontal and vertical lines, the former of which correspond to certain temperatures, and the latter record the hours. And, by a modification of its striking works, the same clock work which governs the motion of these rollers, causes a vertical bar to press, at the end of every five minutes, the needle point through the paper, from which it is immediately withdrawn by a spring, thus impressing a permanent and easily visible mark recording the temperature of the instrument at that instant of time.

So far, the apparatus has been constructed, and in action for some time in the Hall of the Institute, as well as elsewhere; and it will be seen by the record submitted to the Committee that its operation is entirely satisfactory, tracing a curve of temperatures by observations so close together that no appreciable error can be committed in determining from it either the maximum and minimum, or the mean temperature of the day.

As to the originality of this instrument, the Committee have no

recollection of having ever seen or read of the application of the expansive force of a gas or liquid to produce a permanent record of temperatures, by the displacement of a mass of heavy matter relative to an axis of motion: they have, therefore, no cause to doubt the originality of its invention.

As to its utility, it appears to the Committee to possess the following advantages:—

1st. The power developed by the instrument is considerable. The mechanical force exerted by the displacement of a mass of mercury with a considerable leverage from the centre of motion, is so great as to ensure the satisfactory operation of the instrument, and to allow of considerable resistance at its working parts without deranging its action.

2d. This instrument is invariable; being once graduated and set, very ordinary care is sufficient to prevent any derangement of its mechanism; its record will, therefore, probably remain the same, without derangement of its zero or change in the length of its degree.

3d. It is, considering its utility, not too expensive. The inventor estimates that a perfect instrument may be made for $20 to $50. This includes, of course, no estimate for ornamentation. For a meteorological observatory, or for the ordinary recording of atmospheric temperatures at home, this is not an extravagant expense. And it does not appear that any more repairs ought to be required for an apparatus of this kind than for the common clock, which forms its basis.

It is, however, only for recording atmospheric temperatures, and for observatories or houses that the apparatus is fitted. It occupies considerable space, and from its structure could not be conveniently carried in traveling, except by sea. As, however, the scale and the motion of the paper may be varied at pleasure within extensive limits, it appears possible to arrange the apparatus either for very delicate registering during a comparatively short time, or for a long continued course. If the clock could be kept in motion, as is now quite possible, there is no reason why the apparatus might not be left to itself, to record the temperatures during a whole year, during which time it would require neither superintendence nor adjustment.

Mr. Hall, moreover, proposes modifications in the form of the instrument, by means of which it may be made to record within an apartment the temperature of the air outside, indicating the actual temperature at every instant, while it records them as usual every five minutes.

He also has devised an ingenious self-recording barometer, on the same general principle of obtaining the record. These instruments, however, will more properly form the subject of separate reports, when they shall have been so far perfected as to be submitted to the inspection of the Committee.

At present, the Committee confines itself to the expression of the opinion that the instrument constructed and exhibited by Mr. Hall is new, ingenious, and useful, and worthy the attention of all who take an interest in meteorological records.

By order of the Committee,

Philadelphia, March 10, 1859. Wm. Hamilton, *Actuary.*

Abstract of Meteorological Observations for March, 1859; made in Philadelphia, Somerset, and Dauphin Counties, Pennsylvania, for the Committee on Meteorology of the Franklin Institute.

1859.	Philadelphia.—Lat. 39° 57′ 28″ N. Long. 75° 10′ 28″ W. Height above the sea 50 feet. Prof. J. A. Kirkpatrick, Observer.									Somerset, Somerset Co. Lat. 40° N., Lon. 79° 3′ W. Height 2195 feet. Geo. Mowry, Observer.								Harrisburg, Dauphin Co. Lat. 40° 16′, N. Long. 76° 15′, W. John Heisely, M D., Observer.					
	Barometer.		Thermometer.			Relative humidity.	Force of vapor.	Rain and Snow.	Prevail'g winds.	Barometer.		Ther.		Relative humidity.	Force of vapor.	Rain and melt'd Snow.	Prevail'g winds	Barometer.		Ther.		Rain and Snow.	Prevail'g winds
March	Mean.	Mean daily range.	Mean.	Daily oscillation.	Mean daily range.	2 P. M.	2 P.M.			Mean.	Mean daily range.	Mean.	Mean daily range.	2 P. M.	2 P.M.			Mean.	Mean daily range.	Mean.	Mean daily range.		
	Inch.	Inch.	°	°	°	Per ct.	Inch.	Inches.	Direc.	Inch.	Inch.	°	°	Per ct.	Inch.	Inch.	Direc.	Inch.	Inch.	°	°	Inch.	Direc.
1	30·073	·270	34·3	12	8·3	34	·091		N W.	27·818	·187	27·7	4·6	54	·107		N W.	30·016	·304	36·0	5·7		N W.
2	30·342	·269	29·3	18	5 0	46	·097		NNW.	27·927	·113	25·7	2·0	59	·121		S E.	30·264	·248	30·3	5·7		N W.
3	29·960	·382	32·8	13	5·5	89	·168	1 723	E S E.	27·422	·505	31·3	6·3	89	·175	0·518	S E.	29·787	·476	33·3	4·3	} 1·038	S E.
● 4	29·438	·522	46·7	20	13·8	39	·167	0·010	S W.	27·136	·286	39·3	8·0	61	·182	0 165	W.	29 241	·545	42·0	8·7		W.
5	29·603	·145	44 0	10	5·0	42	·142		WNW	27·419	·284	35·0	4·3	82	·212		W.	29·543	·302	41·7	1·7		N W.
6	29·987	·384	46·3	18	4·7	43	·180		W.	27·690	·271	38·3	9·3	53	·207		S E.	29·893	·350	43·3	2·3		N W.
7	29·832	·210	44·0	16	2·3	65	·245	0·757	E.	27·418	·272	38·3	10·7	86	·192		S E.	29·707	·226	40·7	2·7	} 1·780	(var.)
8	29·378	·454	45·7	8	5·0	85	·285	0·127	N E.	27·192	·289	40·0	3·7	100	·257	0·623	W.	29·225	·482	45·7	5·0		E.
9	29·815	·437	46·3	17	5·3	32	·133		N W.	27·616	·424	38·0	5·3	72	·221		W.	29·698	·472	47·0	3·3		N W.
10	30·033	·218	43·7	21	2·7	37	·156		S W.	27·662	·049	42·7	6·0	70	·288		S E.	29·904	·206	44·3	2·3		S E.
☽ 11	29·953	·080	50·7	20	7·0	64	·308		S S E.	27·528	·134	50·3	8·7	71	·367	0·275	S S E.	29·795	·109	48·0	4·0	0·353	E.
12	29·806	·154	58·5	14	7·8	59	·375	0·546	S W.	27·573	·138	47·0	5·0	60	·262		(var.)	29·684	·160	56·3	9·0		W.
13	30 050	·244	56·3	23	3·5	26	·175		S W.	27·784	·208	46·7	9·0	61	·340		?	29·930	·245	53·0	3·3		W.
14	29·984	·099	52·7	21	3·7	33	·188	} 1·300	(var.)	27·525	·259	49·3	12·0	92	311	0·257	(var.)	29·804	·142	50·7	3·7	0·848	E
15	29 556	·428	55·7	14	7·7	71	·367		S W.	27·367	·265	39·7	9·7	71	·201		W.	29·429	·377	54·3	6·3		N W.
16	29·983	·427	48·7	16	7·0	40	·179		W.	27·769	·403	37·7	5·3	53	·159		(var.)	29·889	·461	48·3	6·7		N W.
17	30·034	·113	51·0	23	3·0	36	·201		S W.	27·644	·152	49·3	11·7	49	·315	} 1·032	S W.	29·876	·118	51·7	5·3		S E.
○ 18	29·431	·604	58·7	17	7·7	89	·549	0·462	S E.	26·967	·677	52·7	9·3	87	·362		S.	29·114	·759	58·0	6 3	1·133	S.
19	29·336	·220	42 8	5	16·3	51	·142		S W.	27·163	·359	27·3	22·0	100	·153		W.	29·180	·317	41·7	16·3		N W.
20	29·755	·420	45·3	18	7·0	30	·122		W.	27·645	·482	32·7	6·0	64	·152		W.	29·700	·520	44·0	6·3		N W.
21	29·927	·171	45·3	20	1 3	36	·146		WSW.	27·633	·031	48·0	15·3	60	·324		S.	29·826	·141	45·7	1·7		(var.)
22	29 723	·204	54·8	28	9·5	56	·397	0·375	(var.)	27·480	·153	49·3	10·0	90	·328		WSW.	29·622	·204	50·7	5·0	0·172	S E.
23	29·761	·098	55·2	19	4·3	28	·162		N W.	27·602	·122	46·0	8·7	54	·268		(var.)						N W.
24	29·681	·114	50·0	11	4·8	74	·308	0·472	S E.	27 347	·255	54·0	8·0	77	·429	0·164	(var.)	29·535		51·7		0·120	S E.
25	29·514	·167	52·3	15	2·3	76	·380	0·211	(var.)	27·300	·066	40·0	14·0	65	·168		W.	29·368	·167	52·7	4·3		N W.
☾ 26	29·605	·091	42·0	13	10·3	37	·129		N W.	27·412	·112	31·3	8·7	54	·123	0·071	W.	29·531	·162	42·0	10·7		N W.
27	29·656	·051	49·2	22	8·5	53	·236		S W.	27·318	·094	53·7	22·3	67	·385		(var.)	29·475	·097	49·3	10·0		S.
28	29·608	·048	57·0	27	4·5	48	·353		S E.	27·265	·069	55·7	2·7	56	·352		S S E.	29·454	·020	56·3	7·0		S E.
29	29·339	·269	53·7	11	6·7	87	·407	0·520	(var.)	27·081	·191	48·3	8·0	67	·269	0·173	W.	29·162	·293	55·0	6·7	0·617	(var.)
30	29·545	·209	51·0	13	2·7	30	·141		W.	27·353	·267	39·3	9·0	53	·182		W.	29·468	·307	50·0	5·0		W.
31	29·796	·248	48·2	20	4·2	23	·114		(var.)	27·633	·279	39·0	3 7	53	·159		W.	29·755	·286	47·0	3·0		N W.
Means	29·758	·250	48·1	17	6·0	50	·227	6·503	s.67°w	27·474	·238	41·6	8·7	69	·244	3·278		29 629	·283	47·0	5·6	6·061	

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